# Appendix 1
# Lidar Patch Check Areas

## Area 1

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| JP03 | 558518.69 | 3633625.16 | 30°01'51.96103"N | 90°13'06.29152"W | -5.38 | CHK |
| JP04 | 560557.95 | 3624734.09 | 30°02'12.99285"N | 90°14'47.21895"W | -4.16 | RTK BASE |
| P1A1 | 560541.09 | 3624777.84 | 30°02'12.82188"N | 90°14'46.72293"W | -4.47 | 4111-HORZ |
| P1A2 | 560540.88 | 3624781.84 | 30°02'12.81938"N | 90°14'46.67752"W | -4.25 | 4111-HORZ |
| P1A3 | 560537.99 | 3624826.74 | 30°02'12.78660"N | 90°14'46.16702"W | -4.63 | 4111-HORZ |
| P1A4 | 560534.46 | 3624882.47 | 30°02'12.74640"N | 90°14'45.53336"W | -4.55 | 4111-HORZ |
| P1A5 | 560529.67 | 3624961.36 | 30°02'12.69158"N | 90°14'44.63629"W | -4.69 | 4111-HORZ |
| P1A6 | 560527.35 | 3624997.05 | 30°02'12.66523"N | 90°14'44.23055"W | -5.19 | 4111-HORZ |
| P1A7 | 560526.86 | 3625004.99 | 30°02'12.65963"N | 90°14'44.14022"W | -5.46 | 4111-HORZ |
| P1A8 | 560525.53 | 3625025.24 | 30°02'12.64459"N | 90°14'43.91000"W | -4.89 | 4111-HORZ |
| P1A9 | 560525.09 | 3625032.06 | 30°02'12.63957"N | 90°14'43.83245"W | -5.21 | 4111-HORZ |
| P1A10 | 560528.68 | 3625033.42 | 30°02'12.67503"N | 90°14'43.81663"W | -5.14 | 4111-HORZ |
| P1A11 | 560529.42 | 3625025.24 | 30°02'12.68306"N | 90°14'43.90960"W | -4.84 | 4111-HORZ |
| P1A12 | 560531.51 | 3624992.79 | 30°02'12.70677"N | 90°14'44.27859"W | -5.13 | 4111-HORZ |
| P1A13 | 560534.47 | 3624945.46 | 30°02'12.74056"N | 90°14'44.81668"W | -4.74 | 4111-HORZ |
| P1A14 | 560538.61 | 3624878.56 | 30°02'12.78779"N | 90°14'45.57733"W | -4.56 | 4111-HORZ |
| P1A15 | 560541.88 | 3624826.64 | 30°02'12.82508"N | 90°14'46.16765"W | -4.46 | 4111-HORZ |
| P1A16 | 560544.92 | 3624778.00 | 30°02'12.85978"N | 90°14'46.72075"W | -4.26 | 4111-HORZ |
| P1A17 | 560439.35 | 3625204.39 | 30°02'11.77471"N | 90°14'41.88117"W | -5.66 | 4111 |
| P1A18 | 560438.30 | 3625221.75 | 30°02'11.76259"N | 90°14'41.68376"W | -5.67 | 4111 |
| P1A19 | 560437.14 | 3625237.97 | 30°02'11.74966"N | 90°14'41.49937"W | -5.59 | 4111 |
| P1A20 | 560436.11 | 3625253.78 | 30°02'11.73798"N | 90°14'41.31960"W | -5.56 | 4111 |
| P1A21 | 560435.09 | 3625271.82 | 30°02'11.72611"N | 90°14'41.11445"W | -5.64 | 4111 |
| P1A22 | 560433.99 | 3625290.01 | 30°02'11.71351"N | 90°14'40.90768"W | -5.76 | 4111 |
| P1A23 | 560432.87 | 3625308.76 | 30°02'11.70074"N | 90°14'40.69447"W | -5.76 | 4111 |
| P1A24 | 560431.45 | 3625327.40 | 30°02'11.68490"N | 90°14'40.48247"W | -5.71 | 4111 |
| P1A25 | 560430.41 | 3625345.24 | 30°02'11.67295"N | 90°14'40.27968"W | -5.56 | 4111 |
| P1A26 | 560429.07 | 3625362.81 | 30°02'11.65795"N | 90°14'40.07989"W | -5.57 | 4111 |
| P1A27 | 560428.11 | 3625379.92 | 30°02'11.64691"N | 90°14'39.88541"W | -5.44 | 4111 |
| P1A28 | 560426.65 | 3625400.50 | 30°02'11.63048"N | 90°14'39.65136"W | -5.25 | 4111 |
| P1A29 | 560425.27 | 3625421.05 | 30°02'11.61493"N | 90°14'39.41771"W | -5.56 | 4111 |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P1A30 | 560424.14 | 3625439.07 | 30°02'11.60206"N | 90°14'39.21285"W | -5.65 | 4111 |
| P1A31 | 560423.00 | 3625455.40 | 30°02'11.58921"N | 90°14'39.02717"W | -5.63 | 4111 |
| P1A32 | 560533.70 | 3625829.71 | 30°02'12.64978"N | 90°14'34.75676"W | -5.58 | 3111 |
| P1A33 | 560533.29 | 3625841.68 | 30°02'12.64454"N | 90°14'34.62058"W | -5.54 | 3111 |
| P1A34 | 560532.71 | 3625852.24 | 30°02'12.63786"N | 90°14'34.50051"W | -5.43 | 3111 |
| P1A35 | 560531.59 | 3625864.87 | 30°02'12.62557"N | 90°14'34.35691"W | -5.39 | 3111 |
| P1A36 | 560530.43 | 3625876.45 | 30°02'12.61303"N | 90°14'34.22532"W | -5.34 | 3111 |
| P1A37 | 560529.18 | 3625888.48 | 30°02'12.59948"N | 90°14'34.08856"W | -5.44 | 3111 |
| P1A38 | 560527.39 | 3625900.61 | 30°02'12.58059"N | 90°14'33.95080"W | -5.30 | 3111 |
| P1A39 | 560525.35 | 3625830.07 | 30°02'12.56706"N | 90°14'34.75351"W | -5.50 | 3111 |
| P1A40 | 560522.38 | 3625841.45 | 30°02'12.53659"N | 90°14'34.62436"W | -5.47 | 3111 |
| P1A41 | 560520.17 | 3625852.58 | 30°02'12.51371"N | 90°14'34.49798"W | -5.46 | 3111 |
| P1A42 | 560517.82 | 3625864.15 | 30°02'12.48933"N | 90°14'34.36665"W | -5.40 | 3111 |
| P1A43 | 560516.04 | 3625876.36 | 30°02'12.47052"N | 90°14'34.22787"W | -5.34 | 3111 |
| P1A44 | 560517.08 | 3625888.20 | 30°02'12.47975"N | 90°14'34.09306"W | -5.35 | 3111 |
| P1A45 | 560516.73 | 3625899.51 | 30°02'12.47518"N | 90°14'33.96445"W | -5.28 | 3111 |
| P1A46 | 560515.70 | 3625910.92 | 30°02'12.46394"N | 90°14'33.83472"W | -5.19 | 3111 |
| P1A47 | 560782.24 | 3624817.76 | 30°02'15.20519"N | 90°14'46.24275"W | -4.32 | 6111 |
| P1A48 | 560795.65 | 3624832.84 | 30°02'15.33656"N | 90°14'46.06977"W | -4.37 | 6111 |
| P1A49 | 560806.16 | 3624845.26 | 30°02'15.43936"N | 90°14'45.92730"W | -4.29 | 6111 |
| P1A50 | 560825.00 | 3624865.46 | 30°02'15.62397"N | 90°14'45.69548"W | -4.37 | 6111 |
| P1A51 | 560837.95 | 3624879.66 | 30°02'15.75081"N | 90°14'45.53257"W | -4.60 | 6111 |
| P1A52 | 560849.64 | 3624892.41 | 30°02'15.86536"N | 90°14'45.38624"W | -4.54 | 6111 |
| P1A53 | 560871.74 | 3624914.93 | 30°02'16.08203"N | 90°14'45.12765"W | -4.43 | 6111 |
| P1A54 | 560881.46 | 3624924.64 | 30°02'16.17730"N | 90°14'45.01605"W | -4.63 | 6111 |
| P1A55 | 560890.87 | 3624934.30 | 30°02'16.26958"N | 90°14'44.90521"W | -4.64 | 6111 |
| P1A56 | 560906.35 | 3624950.13 | 30°02'16.42128"N | 90°14'44.72344"W | -4.46 | 6111 |
| P1A57 | 561205.92 | 3625256.64 | 30°02'19.35783"N | 90°14'41.20385"W | 21.58 | 4111-FLDWALL-HORZ |
| P1A58 | 561202.26 | 3625303.80 | 30°02'19.31717"N | 90°14'40.66765"W | 21.64 | 4111-FLDWALL-HORZ |
| P1A59 | 561318.72 | 3625439.20 | 30°02'20.45732"N | 90°14'39.11463"W | 18.60 | 4111-FLDWALL-HORZ |
| P1A60 | 561376.83 | 3625468.32 | 30°02'21.02980"N | 90°14'38.77709"W | 18.55 | 4111-FLDWALL-HORZ |
| P1A61 | 561093.33 | 3625179.46 | 30°02'18.25068"N | 90°14'42.09413"W | -4.47 | 3121 |
| P1A62 | 561099.16 | 3625185.72 | 30°02'18.30773"N | 90°14'42.02228"W | -4.23 | 3121 |
| P1A63 | 561104.72 | 3625191.76 | 30°02'18.36224"N | 90°14'41.95294"W | -3.70 | 3121 |
| P1A64 | 561110.34 | 3625198.10 | 30°02'18.41727"N | 90°14'41.88018"W | -3.01 | 3121 |
| P1A65 | 561116.43 | 3625204.33 | 30°02'18.47694"N | 90°14'41.80867"W | -2.08 | 3121 |
| P1A66 | 561122.85 | 3625210.13 | 30°02'18.53992"N | 90°14'41.74203"W | -1.20 | 3121 |
| P1A67 | 561130.71 | 3625203.46 | 30°02'18.61839"N | 90°14'41.81703"W | -1.08 | 3121 |
| P1A68 | 561126.10 | 3625198.26 | 30°02'18.57326"N | 90°14'41.87670"W | -1.85 | 3121 |
| P1A69 | 561121.35 | 3625192.78 | 30°02'18.52673"N | 90°14'41.93956"W | -2.70 | 3121 |
| P1A70 | 561116.41 | 3625186.94 | 30°02'18.47839"N | 90°14'42.00655"W | -3.46 | 3121 |
| P1A71 | 561111.29 | 3625181.37 | 30°02'18.42822"N | 90°14'42.07041"W | -4.05 | 3121 |
| P1A72 | 561105.01 | 3625175.37 | 30°02'18.36665"N | 90°14'42.13937"W | -4.37 | 3121 |
| P1A73 | 561114.60 | 3625167.63 | 30°02'18.46233"N | 90°14'42.22639"W | -4.30 | 3121 |
| P1A74 | 561120.41 | 3625173.12 | 30°02'18.51930"N | 90°14'42.16327"W | -4.03 | 3121 |
| P1A75 | 561126.41 | 3625178.47 | 30°02'18.57818"N | 90°14'42.10174"W | -3.50 | 3121 |
| P1A76 | 561132.83 | 3625183.62 | 30°02'18.64121"N | 90°14'42.04245"W | -2.64 | 3121 |
| P1A77 | 561138.64 | 3625188.69 | 30°02'18.69831"N | 90°14'41.98418"W | -1.66 | 3121 |
| P1A78 | 561144.48 | 3625191.66 | 30°02'18.75580"N | 90°14'41.94974"W | -0.88 | 3121 |
| P1A79 | 561189.94 | 3625517.17 | 30°02'19.17518"N | 90°14'38.24145"W | -4.94 | A111 |
| P1A80 | 561201.35 | 3625524.28 | 30°02'19.28748"N | 90°14'38.15935"W | -4.80 | A111 |
| P1A81 | 561211.75 | 3625532.56 | 30°02'19.38966"N | 90°14'38.06408"W | -4.88 | A111 |
| P1A82 | 561220.35 | 3625538.79 | 30°02'19.47413"N | 90°14'37.99227"W | -4.82 | A111 |
| P1A83 | 561228.50 | 3625545.07 | 30°02'19.55428"N | 90°14'37.91983"W | -4.82 | A111 |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P1A84 | 561219.34 | 3625559.93 | 30°02'19.46219"N | 90°14'37.75184"W | -4.88 | A111 |
| P1A85 | 561209.24 | 3625553.77 | 30°02'19.36275"N | 90°14'37.82293"W | -4.92 | A111 |
| P1A86 | 561201.46 | 3625547.13 | 30°02'19.28640"N | 90°14'37.89933"W | -4.88 | A111 |
| P1A87 | 561193.57 | 3625540.61 | 30°02'19.20888"N | 90°14'37.97444"W | -4.96 | A111 |
| P1A88 | 561182.95 | 3625531.73 | 30°02'19.10457"N | 90°14'38.07657"W | -4.95 | A111 |
| P1A89 | 560871.85 | 3624982.19 | 30°02'16.07676"N | 90°14'44.36235"W | -4.09 | 3111-ASPHALT |
| P1A90 | 560858.48 | 3624968.91 | 30°02'15.94572"N | 90°14'44.51496"W | -3.99 | 3111-ASPHALT |
| P1A91 | 560845.33 | 3624955.77 | 30°02'15.81676"N | 90°14'44.66584"W | -3.94 | 3111-ASPHALT |
| P1A92 | 560832.18 | 3624942.62 | 30°02'15.68783"N | 90°14'44.81691"W | -3.92 | 3111-ASPHALT |
| P1A93 | 560838.44 | 3624935.43 | 30°02'15.75047"N | 90°14'44.89795"W | -3.74 | 3111-ASPHALT |
| P1A94 | 560850.78 | 3624947.47 | 30°02'15.87151"N | 90°14'44.75970"W | -3.76 | 3111-ASPHALT |
| P1A95 | 560862.68 | 3624959.45 | 30°02'15.98815"N | 90°14'44.62207"W | -3.83 | 3111-ASPHALT |
| P1A96 | 560875.12 | 3624971.97 | 30°02'16.11015"N | 90°14'44.47832"W | -3.86 | 3111-ASPHALT |
| P1A97 | 560879.43 | 3624976.08 | 30°02'16.15235"N | 90°14'44.43102"W | -3.91 | 3111-ASPHALT |
| P1A98 | 560885.22 | 3624970.33 | 30°02'16.21025"N | 90°14'44.49583"W | -4.11 | 3111-ASPHALT |
| P1A99 | 560874.99 | 3624959.75 | 30°02'16.11000"N | 90°14'44.61732"W | -4.04 | 3111-ASPHALT |
| P1A100 | 560862.66 | 3624947.66 | 30°02'15.98908"N | 90°14'44.75625"W | -3.96 | 3111-ASPHALT |
| P1A101 | 560849.98 | 3624935.04 | 30°02'15.86471"N | 90°14'44.90112"W | -3.97 | 3111-ASPHALT |
| P1A102 | 560839.85 | 3624924.97 | 30°02'15.76542"N | 90°14'45.01681"W | -3.96 | 3111-ASPHALT |

## Area 2

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. StatePlane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| ALCO | 557299.70 | 3667048.43 | 30°01'36.52294"N | 90°06'46.21053"W | 6.14 | RTK BASE |
| LOND | 555491.49 | 3680327.10 | 30°01'17.19989"N | 90°04'15.38392"W | 8.78 | CHK |
| P2A1 | 557263.53 | 3667052.00 | 30°01'36.16446"N | 90°06'46.17437"W | 5.45 | 4111 |
| P2A2 | 557266.39 | 3667043.38 | 30°01'36.19371"N | 90°06'46.27200"W | 5.51 | 4111 |
| P2A3 | 557268.87 | 3667035.64 | 30°01'36.21911"N | 90°06'46.35983"W | 5.55 | 4111 |
| P2A4 | 557270.91 | 3667023.35 | 30°01'36.24056"N | 90°06'46.49939"W | 5.76 | 4111 |
| P2A5 | 557271.11 | 3667014.66 | 30°01'36.24349"N | 90°06'46.59816"W | 5.78 | 4111 |
| P2A6 | 557270.88 | 3667007.52 | 30°01'36.24196"N | 90°06'46.67943"W | 5.81 | 4111 |
| P2A7 | 557269.76 | 3667000.12 | 30°01'36.23160"N | 90°06'46.76377"W | 5.78 | 4111 |
| P2A8 | 557268.43 | 3666992.73 | 30°01'36.21927"N | 90°06'46.84795"W | 5.68 | 4111 |
| P2A9 | 557266.50 | 3666985.65 | 30°01'36.20091"N | 90°06'46.92875"W | 5.59 | 4111 |
| P2A10 | 557264.17 | 3666978.18 | 30°01'36.17864"N | 90°06'47.01405"W | 5.56 | 4111 |
| P2A11 | 557264.53 | 3667174.55 | 30°01'36.16148"N | 90°06'44.78013"W | 6.85 | A111 |
| P2A12 | 557269.89 | 3667187.29 | 30°01'36.21324"N | 90°06'44.63457"W | 6.75 | A111 |
| P2A13 | 557276.33 | 3667201.16 | 30°01'36.27545"N | 90°06'44.47602"W | 6.80 | A111 |
| P2A14 | 557281.04 | 3667214.90 | 30°01'36.32066"N | 90°06'44.31914"W | 6.72 | A111 |
| P2A15 | 557287.14 | 3667228.44 | 30°01'36.37963"N | 90°06'44.16441"W | 6.74 | A111 |
| P2A16 | 557291.09 | 3667240.33 | 30°01'36.41742"N | 90°06'44.02863"W | 6.70 | A111 |
| P2A17 | 557294.56 | 3667253.38 | 30°01'36.45046"N | 90°06'43.87979"W | 6.83 | A111 |
| P2A18 | 557300.02 | 3667266.92 | 30°01'36.50306"N | 90°06'43.72502"W | 6.93 | A111 |
| P2A19 | 557304.82 | 3667279.66 | 30°01'36.54921"N | 90°06'43.57952"W | 6.96 | A111 |
| P2A20 | 557309.68 | 3667292.69 | 30°01'36.59595"N | 90°06'43.43072"W | 7.13 | A111 |
| P2A21 | 557314.12 | 3667306.56 | 30°01'36.63843"N | 90°06'43.27245"W | 7.22 | A111 |
| P2A22 | 557316.45 | 3667319.43 | 30°01'36.66011"N | 90°06'43.12568"W | 7.24 | A111 |
| P2A23 | 557320.11 | 3667333.41 | 30°01'36.69491"N | 90°06'42.96631"W | 7.27 | A111 |
| P2A24 | 557322.46 | 3667347.11 | 30°01'36.71667"N | 90°06'42.81016"W | 7.28 | A111 |
| P2A25 | 557326.09 | 3667360.47 | 30°01'36.75121"N | 90°06'42.65776"W | 7.26 | A111 |
| P2A26 | 557095.87 | 3667217.43 | 30°01'34.48745"N | 90°06'44.31279"W | 7.14 | 3121 |
| P2A27 | 557087.08 | 3667208.00 | 30°01'34.40139"N | 90°06'44.42108"W | 6.95 | 3121 |
| P2A28 | 557074.64 | 3667194.63 | 30°01'34.27970"N | 90°06'44.57470"W | 6.68 | 3121 |
| P2A29 | 557062.70 | 3667181.90 | 30°01'34.16288"N | 90°06'44.72096"W | 6.58 | 3121 |
| P2A30 | 557050.77 | 3667169.47 | 30°01'34.04609"N | 90°06'44.86378"W | 6.46 | 3121 |
| P2A31 | 557038.25 | 3667157.16 | 30°01'33.92340"N | 90°06'45.00542"W | 6.35 | 3121 |
| P2A32 | 557026.03 | 3667145.74 | 30°01'33.80370"N | 90°06'45.13679"W | 6.26 | 3121 |
| P2A33 | 557013.91 | 3667134.50 | 30°01'33.68487"N | 90°06'45.26608"W | 6.19 | 3121 |
| P2A34 | 557002.25 | 3667124.24 | 30°01'33.57053"N | 90°06'45.38429"W | 6.10 | 3121 |
| P2A35 | 556989.64 | 3667113.40 | 30°01'33.44682"N | 90°06'45.50902"W | 6.03 | 3121 |
| P2A36 | 556975.69 | 3667102.40 | 30°01'33.30989"N | 90°06'45.63593"W | 6.02 | 3121 |
| P2A37 | 556962.08 | 3667091.56 | 30°01'33.17638"N | 90°06'45.76084"W | 5.75 | 3121 |
| P2A38 | 556948.45 | 3667081.56 | 30°01'33.04247"N | 90°06'45.87622"W | 5.60 | 3121 |
| P2A39 | 556931.72 | 3667076.31 | 30°01'32.87745"N | 90°06'45.93801"W | 5.46 | 3121 |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P2A40 | 556913.45 | 3667065.49 | 30°01'32.69777"N | 90°06'46.06336"W | 5.40 | 3121 |
| P2A41 | 557035.17 | 3667298.85 | 30°01'33.87802"N | 90°06'43.39398"W | 19.06 | BLDG ROOF CORNERS-HO |
| P2A42 | 557022.23 | 3667309.04 | 30°01'33.74883"N | 90°06'43.27964"W | 19.21 | BLDG ROOF CORNERS-HO |
| P2A43 | 557034.47 | 3667324.65 | 30°01'33.86835"N | 90°06'43.10058"W | 19.12 | BLDG ROOF CORNERS-HO |
| P2A44 | 557047.38 | 3667314.52 | 30°01'33.99720"N | 90°06'43.21422"W | 19.00 | BLDG ROOF CORNERS-HO |
| P2A45 | 557004.48 | 3667298.01 | 30°01'33.57430"N | 90°06'43.40725"W | 7.87 | A131 |
| P2A46 | 556990.54 | 3667304.66 | 30°01'33.43564"N | 90°06'43.33322"W | 8.99 | A131 |
| P2A47 | 556979.90 | 3667309.74 | 30°01'33.32977"N | 90°06'43.27679"W | 12.70 | A131 |
| P2A48 | 556967.32 | 3667314.06 | 30°01'33.20472"N | 90°06'43.22911"W | 17.10 | A131 |
| P2A49 | 556958.95 | 3667316.94 | 30°01'33.12161"N | 90°06'43.19736"W | 19.45 | A131 |
| P2A50 | 556950.13 | 3667321.10 | 30°01'33.03385"N | 90°06'43.15117"W | 19.19 | A131 |
| P2A51 | 556939.80 | 3667325.46 | 30°01'32.93115"N | 90°06'43.10279"W | 15.66 | A131 |
| P2A52 | 556927.92 | 3667330.51 | 30°01'32.81298"N | 90°06'43.04677"W | 11.36 | A131 |
| P2A53 | 556914.48 | 3667336.02 | 30°01'32.67942"N | 90°06'42.98574"W | 6.62 | A131 |
| P2A54 | 556904.60 | 3667339.81 | 30°01'32.58116"N | 90°06'42.94385"W | 5.44 | A131 |
| P2A55 | 556898.38 | 3667342.48 | 30°01'32.51933"N | 90°06'42.91423"W | 3.53 | A131 |
| P2A56 | 556891.97 | 3667346.52 | 30°01'32.45546"N | 90°06'42.86905"W | 1.63 | A131 |
| P2A57 | 556879.33 | 3667352.74 | 30°01'32.32970"N | 90°06'42.79987"W | 1.23 | A131 |
| P2A58 | 556627.88 | 3667103.46 | 30°01'29.86691"N | 90°06'45.66602"W | 1.57 | A131-SLOPE |
| P2A59 | 556629.84 | 3667093.93 | 30°01'29.88731"N | 90°06'45.77414"W | 1.70 | A131-SLOPE |
| P2A60 | 556632.18 | 3667082.54 | 30°01'29.91174"N | 90°06'45.90342"W | 4.13 | A131-SLOPE |
| P2A61 | 556633.14 | 3667076.85 | 30°01'29.92181"N | 90°06'45.96807"W | 5.29 | A131-SLOPE |
| P2A62 | 556633.94 | 3667068.40 | 30°01'29.93068"N | 90°06'46.06409"W | 5.82 | A131-SLOPE |
| P2A63 | 556634.18 | 3667064.48 | 30°01'29.93344"N | 90°06'46.10863"W | 6.42 | A131-SLOPE |
| P2A64 | 556635.46 | 3667053.45 | 30°01'29.94723"N | 90°06'46.23400"W | 9.97 | A131-SLOPE |
| P2A65 | 556636.90 | 3667042.99 | 30°01'29.96259"N | 90°06'46.35280"W | 13.58 | A131-SLOPE |
| P2A66 | 556639.33 | 3667032.48 | 30°01'29.98782"N | 90°06'46.47204"W | 16.79 | A131-SLOPE |
| P2A67 | 556640.27 | 3667023.71 | 30°01'29.99796"N | 90°06'46.57163"W | 18.66 | A131-SLOPE |
| P2A68 | 556641.58 | 3667015.19 | 30°01'30.01183"N | 90°06'46.66846"W | 18.51 | A131-SLOPE |
| P2A69 | 556642.50 | 3667007.38 | 30°01'30.02181"N | 90°06'46.75719"W | 16.46 | A131-SLOPE |
| P2A70 | 556644.65 | 3666993.18 | 30°01'30.04457"N | 90°06'46.91845"W | 11.99 | A131-SLOPE |
| P2A71 | 556646.98 | 3666981.56 | 30°01'30.06883"N | 90°06'47.05030"W | 8.32 | A131-SLOPE |
| P2A72 | 556648.06 | 3666975.28 | 30°01'30.08023"N | 90°06'47.12163"W | 6.57 | A131-SLOPE |
| P2A73 | 556650.18 | 3666962.10 | 30°01'30.10262"N | 90°06'47.27130"W | 5.74 | A131-SLOPE |
| P2A74 | 556510.61 | 3666996.84 | 30°01'28.71740"N | 90°06'46.89309"W | 17.80 | CONC FLOODWALL-HORZ |
| P2A75 | 556510.86 | 3666994.78 | 30°01'28.72006"N | 90°06'46.91643"W | 17.77 | CONC FLOODWALL-HORZ |
| P2A76 | 556468.31 | 3666992.13 | 30°01'28.29913"N | 90°06'46.95180"W | 17.81 | CONC FLOODWALL-HORZ |
| P2A77 | 556460.84 | 3666991.38 | 30°01'28.22533"N | 90°06'46.96119"W | 17.81 | CONC FLOODWALL-HORZ |
| P2A78 | 556459.94 | 3666989.42 | 30°01'28.21659"N | 90°06'46.98359"W | 17.79 | CONC FLOODWALL-HORZ |
| P2A79 | 556459.07 | 3666989.80 | 30°01'28.20796"N | 90°06'46.97941"W | 17.80 | CONC FLOODWALL-HORZ |
| P2A80 | 556459.62 | 3666991.26 | 30°01'28.21323"N | 90°06'46.96271"W | 17.83 | CONC FLOODWALL-HORZ |
| P2A81 | 556444.84 | 3666998.04 | 30°01'28.06618"N | 90°06'46.88731"W | 17.89 | CONC FLOODWALL-HORZ |
| P2A82 | 556444.18 | 3666998.30 | 30°01'28.05968"N | 90°06'46.88446"W | 17.22 | CONC FLOODWALL-HORZ |
| P2A83 | 556437.63 | 3667001.06 | 30°01'27.99448"N | 90°06'46.85385"W | 17.23 | CONC FLOODWALL-HORZ |
| P2A84 | 556437.33 | 3667000.64 | 30°01'27.99159"N | 90°06'46.85874"W | 17.22 | CONC FLOODWALL-HORZ |
| P2A85 | 556436.47 | 3667000.22 | 30°01'27.98309"N | 90°06'46.86357"W | 17.24 | CONC FLOODWALL-HORZ |
| P2A86 | 556435.74 | 3667000.19 | 30°01'27.97591"N | 90°06'46.86399"W | 17.24 | CONC FLOODWALL-HORZ |
| P2A87 | 556435.52 | 3667003.14 | 30°01'27.97344"N | 90°06'46.83050"W | 17.23 | CONC FLOODWALL-HORZ |
| P2A88 | 556440.50 | 3667003.48 | 30°01'28.02265"N | 90°06'46.82604"W | 17.21 | CONC FLOODWALL-HORZ |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P2A89 | 556440.65 | 3667002.11 | 30°01'28.02433"N | 90°06'46.84161"W | 17.23 | CONC FLOODWALL-HORZ |
| P2A90 | 556445.05 | 3667000.17 | 30°01'28.06802"N | 90°06'46.86313"W | 17.17 | CONC FLOODWALL-HORZ |
| P2A91 | 556445.35 | 3667000.13 | 30°01'28.07107"N | 90°06'46.86349"W | 17.91 | CONC FLOODWALL-HORZ |
| P2A92 | 556459.96 | 3666993.43 | 30°01'28.21635"N | 90°06'46.93798"W | 17.82 | CONC FLOODWALL-HORZ |
| P2A93 | 556468.45 | 3666994.22 | 30°01'28.30036"N | 90°06'46.92800"W | 17.86 | CONC FLOODWALL-HORZ |
| P2A94 | 557239.33 | 3667866.55 | 30°01'35.83898"N | 90°06'36.91129"W | 2.28 | 3111-ASPHALT |
| P2A95 | 557244.23 | 3667883.97 | 30°01'35.88564"N | 90°06'36.71244"W | 2.27 | 3111-ASPHALT |
| P2A96 | 557249.46 | 3667901.11 | 30°01'35.93558"N | 90°06'36.51684"W | 2.22 | 3111-ASPHALT |
| P2A97 | 557254.24 | 3667918.60 | 30°01'35.98107"N | 90°06'36.31734"W | 2.16 | 3111-ASPHALT |
| P2A98 | 557259.95 | 3667935.56 | 30°01'36.03582"N | 90°06'36.12369"W | 2.16 | 3111-ASPHALT |
| P2A99 | 557284.61 | 3667927.56 | 30°01'36.28073"N | 90°06'36.21169"W | 2.48 | 3111-ASPHALT |
| P2A100 | 557279.42 | 3667909.98 | 30°01'36.23118"N | 90°06'36.41229"W | 2.53 | 3111-ASPHALT |
| P2A101 | 557274.36 | 3667893.17 | 30°01'36.18294"N | 90°06'36.60422"W | 2.56 | 3111-ASPHALT |
| P2A102 | 557268.79 | 3667875.71 | 30°01'36.12960"N | 90°06'36.80345"W | 2.60 | 3111-ASPHALT |
| P2A103 | 557263.20 | 3667858.48 | 30°01'36.07611"N | 90°06'37.00019"W | 2.60 | 3111-ASPHALT |
| P2A104 | 557284.11 | 3667852.16 | 30°01'36.28372"N | 90°06'37.06948"W | 2.35 | 3111-ASPHALT |
| P2A105 | 557289.41 | 3667868.91 | 30°01'36.33444"N | 90°06'36.87827"W | 2.24 | 3111-ASPHALT |
| P2A106 | 557294.58 | 3667886.32 | 30°01'36.38378"N | 90°06'36.67960"W | 2.30 | 3111-ASPHALT |
| P2A107 | 557299.92 | 3667903.46 | 30°01'36.43488"N | 90°06'36.48401"W | 2.32 | 3111-ASPHALT |
| P2A108 | 557305.63 | 3667920.70 | 30°01'36.48955"N | 90°06'36.28717"W | 2.33 | 3111-ASPHALT |

## Area 3

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. StatePlane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| GRAHAM | 559306.75 | 3678458.87 | 30°01'55.16917"N | 90°04'36.15917"W | 6.27 | RTK BASE |
| LOND | 555491.70 | 3680327.26 | 30°01'17.20195"N | 90°04'15.38210"W | 8.76 | CHK |
| P3A1 | 559177.14 | 3680104.71 | 30°01'53.70724"N | 90°04'17.45196"W | 4.57 | 6111 |
| P3A2 | 559181.55 | 3680118.93 | 30°01'53.74931"N | 90°04'17.28971"W | 4.38 | 6111 |
| P3A3 | 559185.55 | 3680132.00 | 30°01'53.78747"N | 90°04'17.14050"W | 4.25 | 6111 |
| P3A4 | 559190.71 | 3680144.86 | 30°01'53.83718"N | 90°04'16.99353"W | 4.16 | 6111 |
| P3A5 | 559195.54 | 3680160.61 | 30°01'53.88323"N | 90°04'16.81369"W | 4.11 | 6111 |
| P3A6 | 559201.25 | 3680176.34 | 30°01'53.93803"N | 90°04'16.63413"W | 4.04 | 6111 |
| P3A7 | 559206.85 | 3680191.65 | 30°01'53.99179"N | 90°04'16.45922"W | 4.13 | 6111 |
| P3A8 | 559212.13 | 3680207.06 | 30°01'54.04237"N | 90°04'16.28324"W | 4.18 | 6111 |
| P3A9 | 559218.78 | 3680224.38 | 30°01'54.10630"N | 90°04'16.08538"W | 4.08 | 6111 |
| P3A10 | 559223.79 | 3680239.32 | 30°01'54.15426"N | 90°04'15.91480"W | 4.10 | 6111 |
| P3A11 | 559271.81 | 3680127.14 | 30°01'54.64192"N | 90°04'17.18495"W | 5.65 | 3111 |
| P3A12 | 559266.82 | 3680112.37 | 30°01'54.59413"N | 90°04'17.35358"W | 5.72 | 3111 |
| P3A13 | 559261.83 | 3680097.17 | 30°01'54.54639"N | 90°04'17.52718"W | 5.79 | 3111 |
| P3A14 | 559256.23 | 3680079.85 | 30°01'54.49284"N | 90°04'17.72491"W | 5.92 | 3111 |
| P3A15 | 559250.68 | 3680063.43 | 30°01'54.43963"N | 90°04'17.91239"W | 6.00 | 3111 |
| P3A16 | 559245.42 | 3680046.50 | 30°01'54.38943"N | 90°04'18.10559"W | 6.05 | 3111 |
| P3A17 | 559240.19 | 3680029.34 | 30°01'54.33958"N | 90°04'18.30153"W | 6.12 | 3111 |
| P3A18 | 559234.58 | 3680012.95 | 30°01'54.28580"N | 90°04'18.48862"W | 6.17 | 3111 |
| P3A19 | 559229.21 | 3679996.82 | 30°01'54.23437"N | 90°04'18.67287"W | 6.25 | 3111 |
| P3A20 | 559223.58 | 3679980.54 | 30°01'54.18042"N | 90°04'18.85873"W | 6.35 | 3111 |
| P3A21 | 559217.76 | 3679962.74 | 30°01'54.12473"N | 90°04'19.06194"W | 6.42 | 3111 |
| P3A22 | 559211.84 | 3679944.18 | 30°01'54.06820"N | 90°04'19.27380"W | 6.44 | 3111 |
| P3A23 | 559207.77 | 3679929.35 | 30°01'54.02951"N | 90°04'19.44310"W | 6.46 | 3111 |
| P3A24 | 559203.24 | 3679913.89 | 30°01'53.98638"N | 90°04'19.61947"W | 6.45 | 3111 |
| P3A25 | 559198.38 | 3679898.71 | 30°01'53.93990"N | 90°04'19.79281"W | 6.42 | 3111 |
| P3A26 | 559242.26 | 3679574.89 | 30°01'54.40956"N | 90°04'23.47112"W | 5.06 | 4111 |
| P3A27 | 559252.32 | 3679581.54 | 30°01'54.50838"N | 90°04'23.39420"W | 5.08 | 4111 |
| P3A28 | 559262.69 | 3679588.37 | 30°01'54.61027"N | 90°04'23.31520"W | 5.05 | 4111 |
| P3A29 | 559273.36 | 3679595.46 | 30°01'54.71512"N | 90°04'23.23328"W | 4.99 | 4111 |
| P3A30 | 559281.52 | 3679600.90 | 30°01'54.79530"N | 90°04'23.17034"W | 5.02 | 4111 |
| P3A31 | 559290.19 | 3679606.40 | 30°01'54.88057"N | 90°04'23.10669"W | 5.02 | 4111 |
| P3A32 | 559299.04 | 3679612.34 | 30°01'54.96745"N | 90°04'23.03797"W | 5.06 | 4111 |
| P3A33 | 559308.17 | 3679618.28 | 30°01'55.05720"N | 90°04'22.96925"W | 5.07 | 4111 |
| P3A34 | 559318.32 | 3679624.95 | 30°01'55.15698"N | 90°04'22.89209"W | 5.04 | 4111 |
| P3A35 | 559326.50 | 3679630.96 | 30°01'55.23730"N | 90°04'22.82278"W | 5.07 | 4111 |
| P3A36 | 559336.46 | 3679639.04 | 30°01'55.33498"N | 90°04'22.72958"W | 5.07 | 4111 |
| P3A37 | 559344.77 | 3679646.16 | 30°01'55.41652"N | 90°04'22.64759"W | 5.07 | 4111 |
| P3A38 | 559352.33 | 3679653.36 | 30°01'55.49058"N | 90°04'22.56469"W | 5.02 | 4111 |
| P3A39 | 559359.38 | 3679660.64 | 30°01'55.55950"N | 90°04'22.48096"W | 5.02 | 4111 |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P3A40 | 559366.49 | 3679668.18 | 30°01'55.62910"N | 90°04'22.39431"W | 5.00 | 4111 |
| P3A41 | 559382.66 | 3679599.92 | 30°01'55.79657"N | 90°04'23.16879"W | 15.32 | CANOPY ROOF CORNERS-HORZ |
| P3A42 | 559400.91 | 3679592.57 | 30°01'55.97799"N | 90°04'23.25021"W | 15.38 | CANOPY ROOF CORNERS-HORZ |
| P3A43 | 559393.65 | 3679574.35 | 30°01'55.90809"N | 90°04'23.45834"W | 15.33 | CANOPY ROOF CORNERS-HORZ |
| P3A44 | 559375.42 | 3679581.62 | 30°01'55.72691"N | 90°04'23.37792"W | 15.40 | CANOPY ROOF CORNERS-HORZ |
| P3A45 | 559396.78 | 3680028.28 | 30°01'55.88967"N | 90°04'18.29399"W | 4.57 | 4111-CONC |
| P3A46 | 559405.96 | 3680028.62 | 30°01'55.98053"N | 90°04'18.28895"W | 4.89 | 4111-CONC |
| P3A47 | 559415.42 | 3680028.53 | 30°01'56.07413"N | 90°04'18.28876"W | 5.00 | 4111-CONC |
| P3A48 | 559415.86 | 3680011.04 | 30°01'56.08040"N | 90°04'18.48768"W | 5.04 | 4111-CONC |
| P3A49 | 559406.53 | 3680010.86 | 30°01'55.98807"N | 90°04'18.49086"W | 4.92 | 4111-CONC |
| P3A50 | 559397.40 | 3680010.52 | 30°01'55.89779"N | 90°04'18.49589"W | 4.55 | 4111-CONC |
| P3A51 | 559398.01 | 3679992.44 | 30°01'55.90577"N | 90°04'18.70152"W | 4.58 | 4111-CONC |
| P3A52 | 559407.22 | 3679992.70 | 30°01'55.99690"N | 90°04'18.69739"W | 4.94 | 4111-CONC |
| P3A53 | 559416.62 | 3679993.16 | 30°01'56.08987"N | 90°04'18.69095"W | 5.01 | 4111-CONC |
| P3A54 | 559417.32 | 3679974.97 | 30°01'56.09879"N | 90°04'18.89779"W | 5.01 | 4111-CONC |
| P3A55 | 559407.74 | 3679974.82 | 30°01'56.00402"N | 90°04'18.90077"W | 4.95 | 4111-CONC |
| P3A56 | 559398.63 | 3679974.33 | 30°01'55.91390"N | 90°04'18.90752"W | 4.59 | 4111-CONC |
| P3A57 | 559399.32 | 3679956.45 | 30°01'55.92268"N | 90°04'19.11080"W | 4.64 | 4111-CONC |
| P3A58 | 559408.40 | 3679956.47 | 30°01'56.01250"N | 90°04'19.10940"W | 4.97 | 4111-CONC |
| P3A59 | 559417.87 | 3679956.87 | 30°01'56.10624"N | 90°04'19.10365"W | 5.01 | 4111-CONC |
| P3A60 | 559097.44 | 3679672.81 | 30°01'52.96535"N | 90°04'22.37535"W | 3.79 | A131-SLOPE |
| P3A61 | 559089.47 | 3679675.67 | 30°01'52.88618"N | 90°04'22.34380"W | 3.97 | A131-SLOPE |
| P3A62 | 559083.60 | 3679677.72 | 30°01'52.82782"N | 90°04'22.32122"W | 5.09 | A131-SLOPE |
| P3A63 | 559069.58 | 3679681.66 | 30°01'52.68855"N | 90°04'22.27809"W | 9.74 | A131-SLOPE |
| P3A64 | 559057.58 | 3679682.75 | 30°01'52.56967"N | 90°04'22.26718"W | 14.07 | A131-SLOPE |
| P3A65 | 559050.40 | 3679684.55 | 30°01'52.49838"N | 90°04'22.24768"W | 16.21 | A131-SLOPE |
| P3A66 | 559038.77 | 3679687.07 | 30°01'52.38299"N | 90°04'22.22039"W | 16.04 | A131-SLOPE |
| P3A67 | 559033.01 | 3679688.68 | 30°01'52.32580"N | 90°04'22.20289"W | 14.43 | A131-SLOPE |
| P3A68 | 559023.90 | 3679691.25 | 30°01'52.23542"N | 90°04'22.17475"W | 10.92 | A131-SLOPE |
| P3A69 | 559012.90 | 3679694.25 | 30°01'52.12614"N | 90°04'22.14201"W | 6.78 | A131-SLOPE |
| P3A70 | 559004.26 | 3679696.99 | 30°01'52.04030"N | 90°04'22.11189"W | 4.19 | A131-SLOPE |
| P3A71 | 558998.59 | 3679699.14 | 30°01'51.98399"N | 90°04'22.08814"W | 3.58 | A131-SLOPE |
| P3A72 | 558984.48 | 3679702.50 | 30°01'51.84400"N | 90°04'22.05173"W | 3.21 | A131-SLOPE |
| P3A73 | 558875.19 | 3679568.86 | 30°01'50.77671"N | 90°04'23.58565"W | 3.40 | 6131-SLOPE |
| P3A74 | 558870.47 | 3679552.49 | 30°01'50.73173"N | 90°04'23.77249"W | 3.82 | 6131-SLOPE |
| P3A75 | 558867.41 | 3679540.27 | 30°01'50.70274"N | 90°04'23.91185"W | 4.05 | 6131-SLOPE |
| P3A76 | 558866.49 | 3679537.09 | 30°01'50.69404"N | 90°04'23.94818"W | 4.86 | 6131-SLOPE |
| P3A77 | 558863.75 | 3679525.26 | 30°01'50.66814"N | 90°04'24.08312"W | 8.70 | 6131-SLOPE |
| P3A78 | 558861.78 | 3679517.41 | 30°01'50.64949"N | 90°04'24.17262"W | 11.23 | 6131-SLOPE |
| P3A79 | 558859.76 | 3679509.85 | 30°01'50.63041"N | 90°04'24.25889"W | 11.38 | 6131-SLOPE |
| P3A80 | 558859.10 | 3679507.74 | 30°01'50.62409"N | 90°04'24.28295"W | 10.85 | 6131-SLOPE |
| P3A81 | 558857.01 | 3679500.58 | 30°01'50.60415"N | 90°04'24.36472"W | 8.27 | 6131-SLOPE |
| P3A82 | 558855.99 | 3679496.95 | 30°01'50.59446"N | 90°04'24.40612"W | 7.39 | 6131-SLOPE |
| P3A83 | 558849.12 | 3679477.38 | 30°01'50.52861"N | 90°04'24.62959"W | 6.81 | 6131-SLOPE |

## Area 4

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. StatePlane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| AP01 | 560498.74 | 3694700.05 | 30°02'05.16913"N | 90°01'31.24202"W | 0.82 | RTK BASE |
| OP16 | 561059.04 | 3699353.00 | 30°02'10.18669"N | 90°00'38.23428"W | -3.68 | CHK |
| P4A1 | 560918.05 | 3696965.19 | 30°02'09.06308"N | 90°01'05.41793"W | 5.10 | 6131-SLOPE |
| P4A2 | 560914.34 | 3696966.43 | 30°02'09.02629"N | 90°01'05.40431"W | 5.49 | 6131-SLOPE |
| P4A3 | 560905.23 | 3696969.71 | 30°02'08.93567"N | 90°01'05.36811"W | 9.15 | 6131-SLOPE |
| P4A4 | 560899.05 | 3696972.28 | 30°02'08.87427"N | 90°01'05.33975"W | 11.84 | 6131-SLOPE |
| P4A5 | 560894.75 | 3696973.20 | 30°02'08.83159"N | 90°01'05.32985"W | 12.75 | 6131-SLOPE |
| P4A6 | 560888.29 | 3696975.49 | 30°02'08.76733"N | 90°01'05.30462"W | 12.53 | 6131-SLOPE |
| P4A7 | 560884.13 | 3696976.69 | 30°02'08.72609"N | 90°01'05.29154"W | 11.51 | 6131-SLOPE |
| P4A8 | 560873.07 | 3696980.31 | 30°02'08.61616"N | 90°01'05.25178"W | 7.50 | 6131-SLOPE |
| P4A9 | 560860.10 | 3696984.95 | 30°02'08.48722"N | 90°01'05.20068"W | 2.62 | 6131-SLOPE |
| P4A10 | 560847.61 | 3696989.13 | 30°02'08.36315"N | 90°01'05.15472"W | -0.97 | 6131-SLOPE |
| P4A11 | 560855.02 | 3696867.71 | 30°02'08.45032"N | 90°01'06.53517"W | 14.12 | 4121-FLOODWALL-HORZ |
| P4A12 | 560851.54 | 3696858.16 | 30°02'08.41688"N | 90°01'06.64420"W | 14.11 | 4121-FLOODWALL-HORZ |
| P4A13 | 560848.20 | 3696838.45 | 30°02'08.38611"N | 90°01'06.86889"W | 12.15 | 4121-FLOODWALL-HORZ |
| P4A14 | 560841.12 | 3696795.46 | 30°02'08.32084"N | 90°01'07.35890"W | 12.17 | 4121-FLOODWALL-HORZ |
| P4A15 | 560840.82 | 3696795.43 | 30°02'08.31792"N | 90°01'07.35923"W | 12.17 | 4121-FLOODWALL-HORZ |
| P4A16 | 560839.60 | 3696787.98 | 30°02'08.30665"N | 90°01'07.44418"W | 12.12 | 4121-FLOODWALL-HORZ |
| P4A17 | 560838.69 | 3696788.15 | 30°02'08.29769"N | 90°01'07.44238"W | 12.15 | 4121-FLOODWALL-HORZ |
| P4A18 | 560839.92 | 3696795.56 | 30°02'08.30904"N | 90°01'07.35785"W | 12.17 | 4121-FLOODWALL-HORZ |
| P4A19 | 560839.57 | 3696795.67 | 30°02'08.30550"N | 90°01'07.35673"W | 12.15 | 4121-FLOODWALL-HORZ |
| P4A20 | 560846.68 | 3696838.78 | 30°02'08.37100"N | 90°01'06.86534"W | 12.18 | 4121-FLOODWALL-HORZ |
| P4A21 | 560849.93 | 3696858.49 | 30°02'08.40094"N | 90°01'06.64067"W | 14.14 | 4121-FLOODWALL-HORZ |
| P4A22 | 560853.53 | 3696868.23 | 30°02'08.43546"N | 90°01'06.52945"W | 14.12 | 4121-FLOODWALL-HORZ |
| P4A23 | 561619.82 | 3697034.44 | 30°02'16.00178"N | 90°01'04.53845"W | 6.51 | 3111 |
| P4A24 | 561633.15 | 3697022.67 | 30°02'16.13508"N | 90°01'04.67058"W | 6.49 | 3111 |
| P4A25 | 561645.66 | 3697009.42 | 30°02'16.26046"N | 90°01'04.81966"W | 6.43 | 3111 |
| P4A26 | 561657.77 | 3696996.56 | 30°02'16.38175"N | 90°01'04.96437"W | 6.40 | 3111 |
| P4A27 | 561669.39 | 3696984.50 | 30°02'16.49816"N | 90°01'05.10016"W | 6.37 | 3111 |
| P4A28 | 561681.51 | 3696971.92 | 30°02'16.61959"N | 90°01'05.24167"W | 6.43 | 3111 |
| P4A29 | 561693.97 | 3696958.57 | 30°02'16.74443"N | 90°01'05.39191"W | 6.47 | 3111 |
| P4A30 | 561706.22 | 3696945.22 | 30°02'16.86713"N | 90°01'05.54216"W | 6.57 | 3111 |
| P4A31 | 561718.26 | 3696933.14 | 30°02'16.98773"N | 90°01'05.67799"W | 6.60 | 3111 |
| P4A32 | 561730.06 | 3696920.13 | 30°02'17.10596"N | 90°01'05.82455"W | 6.65 | 3111 |
| P4A33 | 561741.84 | 3696907.62 | 30°02'17.22398"N | 90°01'05.96533"W | 6.57 | 3111 |
| P4A34 | 561753.76 | 3696894.84 | 30°02'17.34344"N | 90°01'06.10912"W | 6.41 | 3111 |
| P4A35 | 561766.20 | 3696881.43 | 30°02'17.46812"N | 90°01'06.26011"W | 6.40 | 3111 |
| P4A36 | 561777.99 | 3696868.99 | 30°02'17.58629"N | 90°01'06.40007"W | 6.45 | 3111 |
| P4A37 | 561789.56 | 3696856.10 | 30°02'17.70228"N | 90°01'06.54518"W | 6.41 | 3111 |
| P4A38 | 561282.37 | 3697038.93 | 30°02'12.66104"N | 90°01'04.53139"W | 4.35 | 6111 |
| P4A39 | 561280.66 | 3697051.70 | 30°02'12.64264"N | 90°01'04.38637"W | 4.45 | 6111 |
| P4A40 | 561279.29 | 3697065.95 | 30°02'12.62747"N | 90°01'04.22437"W | 4.42 | 6111 |
| P4A41 | 561276.84 | 3697078.96 | 30°02'12.60169"N | 90°01'04.07672"W | 4.41 | 6111 |
| P4A42 | 561274.29 | 3697090.66 | 30°02'12.57515"N | 90°01'03.94391"W | 4.28 | 6111 |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P4A43 | 561271.18 | 3697103.69 | 30°02'12.54289"N | 90°01'03.79617"W | 4.17 | 6111 |
| P4A44 | 561268.95 | 3697120.11 | 30°02'12.51892"N | 90°01'03.60965"W | 4.43 | 6111 |
| P4A45 | 561267.28 | 3697137.54 | 30°02'12.50038"N | 90°01'03.41152"W | 4.33 | 6111 |
| P4A46 | 561264.37 | 3697151.76 | 30°02'12.47002"N | 90°01'03.25014"W | 4.42 | 6111 |
| P4A47 | 561262.74 | 3697163.13 | 30°02'12.45257"N | 90°01'03.12102"W | 4.39 | 6111 |
| P4A48 | 561041.27 | 3696984.74 | 30°02'10.28057"N | 90°01'05.17945"W | 5.20 | 4111 |
| P4A49 | 561044.90 | 3696994.85 | 30°02'10.31537"N | 90°01'05.06395"W | 5.26 | 4111 |
| P4A50 | 561048.50 | 3697004.77 | 30°02'10.34989"N | 90°01'04.95054"W | 5.33 | 4111 |
| P4A51 | 561052.40 | 3697015.40 | 30°02'10.38730"N | 90°01'04.82917"W | 5.35 | 4111 |
| P4A52 | 561055.77 | 3697024.78 | 30°02'10.41961"N | 90°01'04.72202"W | 5.29 | 4111 |
| P4A53 | 561059.23 | 3697034.30 | 30°02'10.45275"N | 90°01'04.61327"W | 5.32 | 4111 |
| P4A54 | 561062.51 | 3697043.29 | 30°02'10.48421"N | 90°01'04.51056"W | 5.31 | 4111 |
| P4A55 | 561065.93 | 3697052.67 | 30°02'10.51700"N | 90°01'04.40332"W | 5.31 | 4111 |
| P4A56 | 561069.19 | 3697061.69 | 30°02'10.54825"N | 90°01'04.30034"W | 5.31 | 4111 |
| P4A57 | 561072.56 | 3697070.81 | 30°02'10.58054"N | 90°01'04.19612"W | 5.31 | 4111 |
| P4A58 | 561075.72 | 3697079.77 | 30°02'10.61084"N | 90°01'04.09382"W | 5.30 | 4111 |
| P4A59 | 561079.24 | 3697089.34 | 30°02'10.64454"N | 90°01'03.98439"W | 5.27 | 4111 |
| P4A60 | 561082.44 | 3697098.14 | 30°02'10.67524"N | 90°01'03.88388"W | 5.24 | 4111 |
| P4A61 | 561085.75 | 3697107.12 | 30°02'10.70703"N | 90°01'03.78126"W | 5.23 | 4111 |
| P4A62 | 561088.18 | 3697113.92 | 30°02'10.73030"N | 90°01'03.70358"W | 5.23 | 4111 |
| P4A63 | 561104.16 | 3697080.23 | 30°02'10.89230"N | 90°01'04.08483"W | 5.87 | 4111-CONC |
| P4A64 | 561099.34 | 3697067.31 | 30°02'10.84606"N | 90°01'04.23248"W | 5.94 | 4111-CONC |
| P4A65 | 561094.71 | 3697054.02 | 30°02'10.80173"N | 90°01'04.38422"W | 6.01 | 4111-CONC |
| P4A66 | 561090.15 | 3697041.81 | 30°02'10.75794"N | 90°01'04.52370"W | 6.01 | 4111-CONC |
| P4A67 | 561086.14 | 3697030.04 | 30°02'10.71964"N | 90°01'04.65812"W | 5.99 | 4111-CONC |
| P4A68 | 561097.54 | 3697026.08 | 30°02'10.83291"N | 90°01'04.70178"W | 5.83 | 4111-CONC |
| P4A69 | 561101.63 | 3697038.18 | 30°02'10.87199"N | 90°01'04.56350"W | 5.85 | 4111-CONC |
| P4A70 | 561105.99 | 3697049.94 | 30°02'10.91380"N | 90°01'04.42914"W | 5.90 | 4111-CONC |
| P4A71 | 561110.86 | 3697063.18 | 30°02'10.96057"N | 90°01'04.27790"W | 5.85 | 4111-CONC |
| P4A72 | 561115.56 | 3697076.56 | 30°02'11.00549"N | 90°01'04.12505"W | 5.84 | 4111-CONC |
| P4A73 | 561126.14 | 3697072.86 | 30°02'11.11065"N | 90°01'04.16577"W | 5.81 | 4111-CONC |
| P4A74 | 561121.30 | 3697059.31 | 30°02'11.06429"N | 90°01'04.32061"W | 5.81 | 4111-CONC |
| P4A75 | 561116.53 | 3697046.08 | 30°02'11.01856"N | 90°01'04.47174"W | 5.84 | 4111-CONC |
| P4A76 | 561112.57 | 3697034.53 | 30°02'10.98073"N | 90°01'04.60368"W | 5.85 | 4111-CONC |
| P4A77 | 561108.45 | 3697022.33 | 30°02'10.94136"N | 90°01'04.74299"W | 5.81 | 4111-CONC |
| P4A78 | 561122.18 | 3697017.70 | 30°02'11.07776"N | 90°01'04.79381"W | 5.61 | 4111-CONC |
| P4A79 | 561126.64 | 3697030.11 | 30°02'11.12046"N | 90°01'04.65204"W | 5.66 | 4111-CONC |
| P4A80 | 561130.23 | 3697041.15 | 30°02'11.15479"N | 90°01'04.52602"W | 5.70 | 4111-CONC |
| P4A81 | 561134.87 | 3697054.46 | 30°02'11.19916"N | 90°01'04.37403"W | 5.69 | 4111-CONC |
| P4A82 | 561139.83 | 3697068.84 | 30°02'11.24668"N | 90°01'04.20978"W | 5.63 | 4111-CONC |
| P4A83 | 561310.87 | 3697210.31 | 30°02'12.92366"N | 90°01'02.57789"W | 20.61 | BLDG ROOF-HORZ |
| P4A84 | 561368.45 | 3697190.03 | 30°02'13.49588"N | 90°01'02.80117"W | 20.76 | BLDG ROOF-HORZ |
| P4A85 | 561388.78 | 3697247.62 | 30°02'13.69063"N | 90°01'02.14325"W | 20.53 | BLDG ROOF-HORZ |
| P4A86 | 561331.23 | 3697267.79 | 30°02'13.11864"N | 90°01'01.92131"W | 20.54 | BLDG ROOF-HORZ |

## Area 5

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. StatePlane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| AG06 | 599773.10 | 3745246.63 | 30°08'27.86084"N | 89°51'50.47976"W | 3.39 | CHK |
| PA5A1 | 596320.54 | 3744312.64 | 30°07'53.80483"N | 89°52'01.61963"W | 3.67 | 3111 |
| PA5A2 | 596338.35 | 3744316.61 | 30°07'53.98066"N | 89°52'01.57182"W | 3.55 | 3111 |
| PA5A3 | 596356.60 | 3744320.77 | 30°07'54.16079"N | 89°52'01.52177"W | 3.37 | 3111 |
| PA5A4 | 596375.43 | 3744324.88 | 30°07'54.34662"N | 89°52'01.47225"W | 3.31 | 3111 |
| PA5A5 | 596392.65 | 3744328.93 | 30°07'54.51657"N | 89°52'01.42354"W | 3.35 | 3111 |
| PA5A6 | 596410.21 | 3744333.04 | 30°07'54.68984"N | 89°52'01.37423"W | 3.34 | 3111 |
| PA5A7 | 596428.68 | 3744337.53 | 30°07'54.87207"N | 89°52'01.32044"W | 3.46 | 3111 |
| PA5A8 | 596446.41 | 3744341.69 | 30°07'55.04703"N | 89°52'01.27047"W | 3.45 | 3111 |
| PA5A9 | 596463.15 | 3744345.75 | 30°07'55.21230"N | 89°52'01.22180"W | 3.38 | 3111 |
| PA5A10 | 596481.47 | 3744350.58 | 30°07'55.39297"N | 89°52'01.16407"W | 3.37 | 3111 |
| PA5A11 | 596498.03 | 3744354.72 | 30°07'55.55637"N | 89°52'01.11452"W | 3.41 | 3111 |
| PA5A12 | 596515.88 | 3744359.85 | 30°07'55.73244"N | 89°52'01.05353"W | 3.41 | 3111 |
| PA5A13 | 596532.90 | 3744363.44 | 30°07'55.90046"N | 89°52'01.01016"W | 3.39 | 3111 |
| PA5A14 | 596549.10 | 3744367.63 | 30°07'56.06029"N | 89°52'00.96012"W | 3.31 | 3111 |
| PA5A15 | 596565.70 | 3744371.60 | 30°07'56.22410"N | 89°52'00.91246"W | 3.22 | 3111 |
| PA5A16 | 596569.70 | 3744326.38 | 30°07'56.26937"N | 89°52'01.42684"W | 15.59 | BLDG ROOF CORNERS-HORZ |
| PA5A17 | 596534.98 | 3744317.99 | 30°07'55.92675"N | 89°52'01.52738"W | 15.08 | BLDG ROOF CORNERS-HORZ |
| PA5A18 | 596544.00 | 3744281.37 | 30°07'56.02069"N | 89°52'01.94305"W | 15.53 | BLDG ROOF CORNERS-HORZ |
| PA5A19 | 597636.65 | 3744577.15 | 30°08'06.79862"N | 89°51'58.41558"W | 2.08 | 5111 |
| PA5A20 | 597641.97 | 3744578.06 | 30°08'06.85116"N | 89°51'58.40446"W | 2.20 | 5111 |
| PA5A21 | 597646.90 | 3744579.08 | 30°08'06.89978"N | 89°51'58.39210"W | 2.11 | 5111 |
| PA5A22 | 597652.87 | 3744580.37 | 30°08'06.95874"N | 89°51'58.37663"W | 2.06 | 5111 |
| PA5A23 | 597659.88 | 3744582.50 | 30°08'07.02781"N | 89°51'58.35135"W | 2.08 | 5111 |
| PA5A24 | 597658.09 | 3744591.54 | 30°08'07.00893"N | 89°51'58.24866"W | 2.09 | 5111 |
| PA5A25 | 597652.13 | 3744591.73 | 30°08'06.94997"N | 89°51'58.24737"W | 2.09 | 5111 |
| PA5A26 | 597646.46 | 3744591.79 | 30°08'06.89377"N | 89°51'58.24745"W | 2.22 | 5111 |
| PA5A27 | 597640.69 | 3744591.84 | 30°08'06.83669"N | 89°51'58.24777"W | 2.38 | 5111 |
| PA5A28 | 597635.52 | 3744591.41 | 30°08'06.78559"N | 89°51'58.25343"W | 2.35 | 5111 |
| PA5A29 | 595989.88 | 3744246.11 | 30°07'50.54036"N | 89°52'02.42530"W | 4.28 | 4111-CONC-BRIDGE |
| PA5A30 | 596009.70 | 3744248.89 | 30°07'50.73614"N | 89°52'02.39082"W | 4.49 | 4111-CONC-BRIDGE |
| PA5A31 | 596029.59 | 3744251.66 | 30°07'50.93263"N | 89°52'02.35638"W | 4.59 | 4111-CONC-BRIDGE |
| PA5A32 | 596049.32 | 3744254.44 | 30°07'51.12762"N | 89°52'02.32183"W | 4.65 | 4111-CONC-BRIDGE |
| PA5A33 | 596069.19 | 3744257.22 | 30°07'51.32397"N | 89°52'02.28731"W | 4.59 | 4111-CONC-BRIDGE |
| PA5A34 | 596088.89 | 3744260.07 | 30°07'51.51860"N | 89°52'02.25197"W | 4.51 | 4111-CONC-BRIDGE |
| PA5A35 | 596108.53 | 3744262.82 | 30°07'51.71260"N | 89°52'02.21782"W | 4.34 | 4111-CONC-BRIDGE |
| PA5A36 | 596106.97 | 3744272.76 | 30°07'51.69597"N | 89°52'02.10480"W | 4.41 | 4111-CONC-BRIDGE |
| PA5A37 | 596087.10 | 3744270.31 | 30°07'51.49959"N | 89°52'02.13564"W | 4.63 | 4111-CONC-BRIDGE |
| PA5A38 | 596067.32 | 3744267.51 | 30°07'51.30409"N | 89°52'02.17040"W | 4.72 | 4111-CONC-BRIDGE |
| PA5A39 | 596047.57 | 3744264.85 | 30°07'51.10894"N | 89°52'02.20354"W | 4.73 | 4111-CONC-BRIDGE |
| PA5A40 | 596027.80 | 3744262.18 | 30°07'50.91361"N | 89°52'02.23687"W | 4.69 | 4111-CONC-BRIDGE |
| PA5A41 | 596007.88 | 3744259.45 | 30°07'50.71681"N | 89°52'02.27077"W | 4.62 | 4111-CONC-BRIDGE |
| PA5A42 | 595988.42 | 3744256.75 | 30°07'50.52454"N | 89°52'02.30445"W | 4.46 | 4111-CONC-BRIDGE |
| PA5A43 | 595987.08 | 3744267.24 | 30°07'50.50994"N | 89°52'02.18512"W | 4.36 | 4111-CONC-BRIDGE |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| PA5A44 | 596006.53 | 3744269.88 | 30°07'50.70207"N | 89°52'02.15225"W | 4.47 | 4111-CONC-BRIDGE |
| PA5A45 | 596026.70 | 3744272.59 | 30°07'50.90141"N | 89°52'02.11850"W | 4.53 | 4111-CONC-BRIDGE |
| PA5A46 | 596046.48 | 3744275.51 | 30°07'51.09681"N | 89°52'02.08229"W | 4.59 | 4111-CONC-BRIDGE |
| PA5A47 | 596065.90 | 3744278.25 | 30°07'51.28868"N | 89°52'02.04832"W | 4.52 | 4111-CONC-BRIDGE |
| PA5A48 | 596085.71 | 3744281.11 | 30°07'51.48448"N | 89°52'02.01281"W | 4.49 | 4111-CONC-BRIDGE |
| PA5A49 | 596105.58 | 3744284.07 | 30°07'51.68075"N | 89°52'01.97623"W | 4.28 | 4111-CONC-BRIDGE |
| PA5A50 | 593472.88 | 3744165.57 | 30°07'25.63655"N | 89°52'03.70913"W | 0.58 | 6131-SLOPE |
| PA5A51 | 593484.75 | 3744163.73 | 30°07'25.75427"N | 89°52'03.72833"W | 3.29 | 6131-SLOPE |
| PA5A52 | 593497.39 | 3744164.22 | 30°07'25.87933"N | 89°52'03.72085"W | 7.47 | 6131-SLOPE |
| PA5A53 | 593511.72 | 3744164.75 | 30°07'26.02106"N | 89°52'03.71274"W | 12.42 | 6131-SLOPE |
| PA5A54 | 593516.20 | 3744164.72 | 30°07'26.06542"N | 89°52'03.71250"W | 13.40 | 6131-SLOPE |
| PA5A55 | 593527.13 | 3744166.04 | 30°07'26.17345"N | 89°52'03.69583"W | 13.34 | 6131-SLOPE |
| PA5A56 | 593530.94 | 3744166.30 | 30°07'26.21107"N | 89°52'03.69237"W | 12.28 | 6131-SLOPE |
| PA5A57 | 593543.89 | 3744166.11 | 30°07'26.33934"N | 89°52'03.69258"W | 7.88 | 6131-SLOPE |
| PA5A58 | 593558.77 | 3744166.47 | 30°07'26.48657"N | 89°52'03.68639"W | 3.44 | 6131-SLOPE |
| PA5A59 | 593566.32 | 3744165.29 | 30°07'26.56144"N | 89°52'03.69869"W | 1.79 | 6131-SLOPE |
| PA5A60 | 593529.92 | 3744319.30 | 30°07'26.18164"N | 89°52'01.95036"W | 13.12 | 4111-CONC-FLOODWALL-HORZ |
| PA5A61 | 593528.34 | 3744319.46 | 30°07'26.16596"N | 89°52'01.94877"W | 13.11 | 4111-CONC-FLOODWALL-HORZ |
| PA5A62 | 593532.63 | 3744379.67 | 30°07'26.20081"N | 89°52'01.26257"W | 13.10 | 4111-CONC-FLOODWALL-HORZ |
| PA5A63 | 593534.85 | 3744410.24 | 30°07'26.21889"N | 89°52'00.91416"W | 13.08 | 4111-CONC-FLOODWALL-HORZ |
| PA5A64 | 593534.78 | 3744410.59 | 30°07'26.21814"N | 89°52'00.91022"W | 12.57 | 4111-CONC-FLOODWALL-HORZ |
| PA5A65 | 593535.00 | 3744413.93 | 30°07'26.21998"N | 89°52'00.87215"W | 12.57 | 4111-CONC-FLOODWALL-HORZ |
| PA5A66 | 593534.31 | 3744414.02 | 30°07'26.21315"N | 89°52'00.87115"W | 12.56 | 4111-CONC-FLOODWALL-HORZ |
| PA5A67 | 593534.56 | 3744417.36 | 30°07'26.21513"N | 89°52'00.83313"W | 12.58 | 4111-CONC-FLOODWALL-HORZ |
| PA5A68 | 593537.18 | 3744417.17 | 30°07'26.24111"N | 89°52'00.83488"W | 12.56 | 4111-CONC-FLOODWALL-HORZ |
| PA5A69 | 593536.95 | 3744413.75 | 30°07'26.23927"N | 89°52'00.87392"W | 12.56 | 4111-CONC-FLOODWALL-HORZ |
| PA5A70 | 593536.38 | 3744410.41 | 30°07'26.23405"N | 89°52'00.91198"W | 12.56 | 4111-CONC-FLOODWALL-HORZ |
| PA5A71 | 593536.40 | 3744409.74 | 30°07'26.23436"N | 89°52'00.91958"W | 13.09 | 4111-CONC-FLOODWALL-HORZ |
| PA5A72 | 593534.18 | 3744379.70 | 30°07'26.21612"N | 89°52'01.26204"W | 13.10 | 4111-CONC-FLOODWALL-HORZ |
| PAT5 | 595878.07 | 3744218.43 | 30°07'49.43710"N | 89°52'02.75684"W | 2.27 | RTK BASE |

## Area 6

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. StatePlane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P6A1 | 609560.11 | 3785078.91 | 30°09'59.46102"N | 89°44'15.30682"W | 9.00 | 411-CONC SLAB-HORZ |
| P6A2 | 609571.64 | 3785072.21 | 30°09'59.57602"N | 89°44'15.38134"W | 9.05 | 411-CONC SLAB-HORZ |
| P6A3 | 609564.98 | 3785060.67 | 30°09'59.51169"N | 89°44'15.51383"W | 9.29 | 411-CONC SLAB-HORZ |
| P6A4 | 609553.33 | 3785067.42 | 30°09'59.39544"N | 89°44'15.43874"W | 9.16 | 411-CONC SLAB-HORZ |
| P6A5 | 609416.36 | 3785025.41 | 30°09'58.04553"N | 89°44'15.93899"W | 1.24 | 6131-SLOPE1 |
| P6A6 | 609405.90 | 3785035.86 | 30°09'57.94054"N | 89°44'15.82164"W | 7.87 | 6131-SLOPE1 |
| P6A7 | 609399.12 | 3785044.10 | 30°09'57.87227"N | 89°44'15.72888"W | 10.57 | 6131-SLOPE1 |
| P6A8 | 609391.92 | 3785056.14 | 30°09'57.79933"N | 89°44'15.59287"W | 10.32 | 6131-SLOPE1 |
| P6A9 | 609390.86 | 3785057.47 | 30°09'57.78872"N | 89°44'15.57791"W | 7.66 | 6131-SLOPE1 |
| P6A10 | 609389.79 | 3785062.56 | 30°09'57.77744"N | 89°44'15.52005"W | 6.63 | 6131-SLOPE1 |
| P6A11 | 609388.05 | 3785065.99 | 30°09'57.75970"N | 89°44'15.48128"W | 5.00 | 6131-SLOPE1 |
| P6A12 | 609386.07 | 3785071.55 | 30°09'57.73937"N | 89°44'15.41830"W | 2.42 | 6131-SLOPE1 |
| P6A13 | 609331.29 | 3785075.10 | 30°09'57.19664"N | 89°44'15.38650"W | 3.07 | 6131-SLOPE2 |
| P6A14 | 609328.30 | 3785073.33 | 30°09'57.16725"N | 89°44'15.40718"W | 4.87 | 6131-SLOPE2 |
| P6A15 | 609322.97 | 3785069.91 | 30°09'57.11504"N | 89°44'15.44690"W | 7.28 | 6131-SLOPE2 |
| P6A16 | 609320.38 | 3785069.30 | 30°09'57.08944"N | 89°44'15.45429"W | 7.56 | 6131-SLOPE2 |
| P6A17 | 609318.18 | 3785069.69 | 30°09'57.06761"N | 89°44'15.45018"W | 10.16 | 6131-SLOPE2 |
| P6A18 | 609303.36 | 3785064.94 | 30°09'56.92157"N | 89°44'15.50672"W | 9.68 | 6131-SLOPE2 |
| P6A19 | 609294.05 | 3785059.36 | 30°09'56.83021"N | 89°44'15.57169"W | 7.44 | 6131-SLOPE2 |
| P6A20 | 609281.67 | 3785053.90 | 30°09'56.70837"N | 89°44'15.63582"W | 3.69 | 6131-SLOPE2 |
| P6A21 | 609273.52 | 3785050.17 | 30°09'56.62825"N | 89°44'15.67969"W | 2.73 | 6131-SLOPE2 |
| P6A22 | 609159.82 | 3784908.50 | 30°09'55.52239"N | 89°44'17.31147"W | 3.58 | 4111-SLAB CONC |
| P6A23 | 609166.95 | 3784887.83 | 30°09'55.59581"N | 89°44'17.54577"W | 3.86 | 4111-SLAB CONC |
| P6A24 | 609136.40 | 3784877.50 | 30°09'55.29483"N | 89°44'17.66828"W | 3.92 | 4111-SLAB CONC |
| P6A25 | 609118.05 | 3784856.03 | 30°09'55.11618"N | 89°44'17.91573"W | 3.91 | 4111-SLAB CONC |
| P6A26 | 609111.16 | 3784824.78 | 30°09'55.05231"N | 89°44'18.27285"W | 3.91 | 4111-SLAB CONC |
| P6A27 | 609093.16 | 3784828.35 | 30°09'54.87359"N | 89°44'18.23497"W | 3.73 | 4111-SLAB CONC |
| P6A28 | 609089.76 | 3784829.22 | 30°09'54.83979"N | 89°44'18.22567"W | 3.28 | 4111-SLAB CONC |
| P6A29 | 609090.99 | 3784834.46 | 30°09'54.85131"N | 89°44'18.16578"W | 3.86 | 4111-SLAB CONC |
| P6A30 | 609098.34 | 3784866.34 | 30°09'54.91965"N | 89°44'17.80140"W | 3.89 | 4111-SLAB CONC |
| P6A31 | 609124.24 | 3784896.42 | 30°09'55.17189"N | 89°44'17.45468"W | 3.79 | 4111-SLAB CONC |
| P6A32 | 609157.67 | 3784907.70 | 30°09'55.50119"N | 89°44'17.32089"W | 3.73 | 4111-SLAB CONC |
| P6A33 | 609160.00 | 3784908.50 | 30°09'55.52412"N | 89°44'17.31140"W | 3.50 | 4111-SLAB CONC |
| P6A34 | 609163.16 | 3784899.13 | 30°09'55.55670"N | 89°44'17.41771"W | 3.98 | 4111-SLAB CONC |
| P6A35 | 609149.18 | 3784893.55 | 30°09'55.41916"N | 89°44'17.48344"W | 4.05 | 4111-SLAB CONC |
| P6A36 | 609134.67 | 3784888.14 | 30°09'55.27620"N | 89°44'17.54732"W | 4.11 | 4111-SLAB CONC |
| P6A37 | 609126.29 | 3784882.22 | 30°09'55.19410"N | 89°44'17.61608"W | 4.18 | 4111-SLAB CONC |
| P6A38 | 609115.52 | 3784869.13 | 30°09'55.08932"N | 89°44'17.76690"W | 4.17 | 4111-SLAB CONC |
| P6A39 | 609108.14 | 3784860.49 | 30°09'55.01742"N | 89°44'17.86650"W | 4.21 | 4111-SLAB CONC |
| P6A40 | 609103.98 | 3784843.28 | 30°09'54.97863"N | 89°44'18.06322"W | 4.22 | 4111-SLAB CONC |
| P6A41 | 609100.82 | 3784826.90 | 30°09'54.94962"N | 89°44'18.25036"W | 4.06 | 4111-SLAB CONC |

| Name | Northing | Easting | Latitude | Longitude | Elevation | Feature Code |
|---|---|---|---|---|---|---|
| P6A42 | 608866.65 | 3784579.37 | 30°09'52.66593"N | 89°44'21.10711"W | 16.60 | BLDG ROOF CORNERS-HO |
| P6A43 | 608842.73 | 3784568.00 | 30°09'52.43067"N | 89°44'21.24032"W | 17.03 | BLDG ROOF CORNERS-HO |
| P6A44 | 608817.67 | 3784620.47 | 30°09'52.17542"N | 89°44'20.64670"W | 16.60 | BLDG ROOF CORNERS-HO |
| P6A45 | 608841.94 | 3784631.95 | 30°09'52.41407"N | 89°44'20.51205"W | 16.75 | BLDG ROOF CORNERS-HO |
| P6A46 | 609078.89 | 3785067.85 | 30°09'54.69939"N | 89°44'15.50917"W | 1.34 | 6111 |
| P6A47 | 609075.05 | 3785056.35 | 30°09'54.66293"N | 89°44'15.64070"W | 1.27 | 6111 |
| P6A48 | 609070.30 | 3785045.21 | 30°09'54.61745"N | 89°44'15.76839"W | 1.29 | 6111 |
| P6A49 | 609065.64 | 3785035.18 | 30°09'54.57267"N | 89°44'15.88335"W | 1.34 | 6111 |
| P6A50 | 609060.16 | 3785025.30 | 30°09'54.51984"N | 89°44'15.99683"W | 1.43 | 6111 |
| P6A51 | 609054.01 | 3785016.49 | 30°09'54.46016"N | 89°44'16.09813"W | 1.38 | 6111 |
| P6A52 | 609048.25 | 3785007.07 | 30°09'54.40443"N | 89°44'16.20636"W | 1.54 | 6111 |
| P6A53 | 609042.21 | 3784997.26 | 30°09'54.34598"N | 89°44'16.31906"W | 1.52 | 6111 |
| P6A54 | 609037.35 | 3784987.98 | 30°09'54.29924"N | 89°44'16.42555"W | 1.61 | 6111 |
| P6A55 | 609034.46 | 3784979.69 | 30°09'54.27178"N | 89°44'16.52037"W | 1.56 | 6111 |
| PIKE RESET | 609582.87 | 3785134.53 | 30°09'59.67859"N | 89°44'14.66962"W | 8.14 | RTK BASE |
| PIKE RM3 | 609562.56 | 3785070.21 | 30°09'59.48642"N | 89°44'15.40546"W | 9.15 | CHK |

# Appendix 2
# Topographic and Hydrographic Cross Section Data

**Orleans and Jefferson Parishes**
**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**Reference Field Book Number 060857 for Raw Data.**

| **Line Name** | **Location** | | |
|---|---|---|---|
| **1-1** | **17th Street Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 555921.54 | 3664525.93 | 3.98 | RR |
| 555921.60 | 3664521.93 | 3.68 | RR |
| 555921.82 | 3664506.93 | 0.48 | RR |
| 555921.92 | 3664499.93 | -1.02 | WE |
| 555924.40 | 3664329.95 | 0.88 | TEF |
| 555924.40 | 3664329.95 | 4.06 | TPF |
| 555924.37 | 3664331.95 | 4.06 | TPF |
| 555924.37 | 3664331.95 | -1.02 | WE |
| 555924.36 | 3664332.95 | -7.42 | TOE |
| 555921.50 | 3664528.93 | 6.28 | TEF |
| 555921.50 | 3664528.93 | 3.92 | TPF |
| 555921.53 | 3664526.93 | 3.92 | TPF |
| 555921.53 | 3664526.93 | 3.68 | TEF |
| 555922.99 | 3664426.94 | -10.03 | SND |
| 555922.84 | 3664436.94 | -9.63 | SND |
| 555922.69 | 3664446.94 | -9.53 | SND |
| 555922.55 | 3664456.94 | -9.43 | SND |
| 555922.40 | 3664466.94 | -9.13 | SND |
| 555922.26 | 3664476.93 | -8.63 | SND |
| 555922.11 | 3664486.93 | -4.93 | SND |
| 555921.96 | 3664496.93 | -1.23 | SND |
| 555924.30 | 3664336.95 | -7.63 | SND |
| 555924.15 | 3664346.95 | -8.33 | SND |

| | | | |
|---|---|---|---|
| 555924.01 | 3664356.95 | -9.73 | SND |
| 555923.86 | 3664366.95 | -10.33 | SND |
| 555923.72 | 3664376.95 | -10.23 | SND |
| 555923.57 | 3664386.94 | -10.33 | SND |
| 555923.42 | 3664396.94 | -9.83 | SND |
| 555923.28 | 3664406.94 | -9.83 | SND |
| 555923.13 | 3664416.94 | -9.83 | SND |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **2-1** | **Orleans Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 557883.54 | 3672102.11 | 6.45 | TPF |
| 557883.47 | 3672101.12 | 6.45 | TPF |
| 557883.20 | 3672097.13 | 3.15 | SLP |
| 557882.64 | 3672089.15 | -0.45 | WES |
| 557869.64 | 3671901.60 | 6.35 | TPF |
| 557869.71 | 3671902.59 | 6.35 | TPF |
| 557870.06 | 3671907.58 | 2.35 | SLP |
| 557870.54 | 3671914.56 | -0.45 | WES |
| 557870.96 | 3671920.55 | -2.84 | SND |
| 557871.65 | 3671930.53 | -4.54 | SND |
| 557872.34 | 3671940.50 | -4.94 | SND |
| 557873.03 | 3671950.48 | -5.04 | SND |
| 557873.72 | 3671960.45 | -5.34 | SND |
| 557874.42 | 3671970.43 | -5.34 | SND |
| 557875.11 | 3671980.41 | -5.44 | SND |
| 557875.80 | 3671990.38 | -5.44 | SND |
| 557876.49 | 3672000.36 | -5.54 | SND |
| 557877.18 | 3672010.33 | -5.54 | SND |
| 557877.87 | 3672020.31 | -5.74 | SND |
| 557878.56 | 3672030.29 | -5.74 | SND |
| 557879.26 | 3672040.26 | -5.94 | SND |
| 557879.95 | 3672050.24 | -6.24 | SND |
| 557880.64 | 3672060.22 | -6.94 | SND |
| 557881.33 | 3672070.19 | -6.54 | SND |
| 557882.02 | 3672080.17 | -6.94 | SND |
| 557882.71 | 3672090.14 | -0.84 | SND |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **3-1** | **Orleans Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 555506.40 | 3671780.92 | 2.53 | FST |
| 555500.57 | 3671744.39 | 1.33 | BSH |
| 555497.89 | 3671727.60 | 0.63 | BSH |
| 555495.84 | 3671714.76 | -0.27 | WES |
| 555461.17 | 3671497.51 | 13.03 | PS |
| 555461.64 | 3671500.47 | 13.03 | CL |
| 555462.75 | 3671507.39 | 12.53 | FSC |
| 555464.32 | 3671517.26 | 9.03 | SLP |

| | | | |
|---|---|---|---|
| 555465.90 | 3671527.14 | 5.63 | SLP |
| 555466.84 | 3671533.06 | 3.83 | FST |
| 555510.81 | 3671808.57 | 12.63 | CL |
| 555510.34 | 3671805.61 | 12.63 | FSC |
| 555508.45 | 3671793.76 | 9.23 | SLP |
| 555467.16 | 3671535.04 | 3.73 | BSH |
| 555467.79 | 3671538.99 | 2.83 | ERK |
| 555470.31 | 3671554.79 | 2.53 | TRK |
| 555471.10 | 3671559.72 | 0.63 | BSH |
| 555471.57 | 3671562.69 | -0.27 | WES |
| 555472.20 | 3671566.64 | -1.63 | SND |
| 555473.78 | 3671576.51 | -3.03 | SND |
| 555475.35 | 3671586.39 | -3.43 | SND |
| 555476.93 | 3671596.26 | -3.73 | SND |
| 555478.51 | 3671606.14 | -4.03 | SND |
| 555480.08 | 3671616.01 | -5.03 | SND |
| 555481.66 | 3671625.89 | -5.03 | SND |
| 555483.23 | 3671635.76 | -6.53 | SND |
| 555484.81 | 3671645.64 | -8.03 | SND |
| 555486.38 | 3671655.51 | -10.13 | SND |
| 555487.96 | 3671665.39 | -10.43 | SND |
| 555489.54 | 3671675.26 | -10.13 | SND |
| 555491.11 | 3671685.14 | -9.43 | SND |
| 555492.69 | 3671695.01 | -7.63 | SND |
| 555494.26 | 3671704.89 | -5.73 | SND |
| 555495.84 | 3671714.76 | -3.93 | SND |
| 555497.42 | 3671724.64 | -0.53 | SND |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **4-1** | **Orleans Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 554569.95 | 3671755.63 | 1.78 | NG |
| 554570.49 | 3671748.65 | 1.38 | TBK |
| 554570.88 | 3671743.66 | 0.28 | TRK |
| 554571.11 | 3671740.67 | -0.42 | WES |
| 554584.30 | 3671571.18 | 13.40 | TPF |
| 554584.14 | 3671573.18 | 13.38 | TPF |
| 554584.14 | 3671573.18 | 7.48 | TEF |
| 554583.83 | 3671577.17 | 7.08 | LSC |
| 554566.61 | 3671798.50 | 10.08 | TEF |
| 554566.84 | 3671795.51 | 9.48 | FSC |
| 554568.39 | 3671775.57 | 3.88 | SLP |
| 554568.63 | 3671772.58 | 3.28 | FST |
| 554583.13 | 3671586.14 | 4.28 | SLP |
| 554582.43 | 3671595.11 | 2.78 | FST |
| 554581.58 | 3671606.08 | 1.58 | NG |
| 554581.04 | 3671613.06 | 1.58 | TBK |
| 554580.88 | 3671615.05 | 0.28 | TOE |
| 554566.53 | 3671799.49 | 13.28 | TPF |
| 554566.61 | 3671798.50 | 13.28 | TPF |

| | | | |
|---|---|---|---|
| 554580.57 | 3671619.04 | -0.42 | WES |
| 554580.03 | 3671626.02 | -3.43 | SND |
| 554579.25 | 3671635.99 | -5.53 | SND |
| 554578.48 | 3671645.96 | -9.73 | SND |
| 554577.70 | 3671655.93 | -11.13 | SND |
| 554576.93 | 3671665.90 | -12.03 | SND |
| 554576.15 | 3671675.87 | -12.33 | SND |
| 554575.38 | 3671685.84 | -12.23 | SND |
| 554574.60 | 3671695.81 | -11.93 | SND |
| 554573.82 | 3671705.78 | -10.73 | SND |
| 554573.05 | 3671715.75 | -9.13 | SND |
| 554572.27 | 3671725.72 | -2.63 | SND |
| 554571.50 | 3671735.69 | -1.93 | SND |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **5-1** | **Orleans Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 545866.33 | 3670816.34 | 14.16 | TPF |
| 545866.32 | 3670817.34 | 14.15 | TPF |
| 545866.32 | 3670817.34 | 0.45 | TEF |
| 545866.26 | 3670821.34 | -0.45 | WES |
| 545864.38 | 3670950.33 | -0.45 | WES |
| 545864.28 | 3670957.33 | 2.75 | SLP |
| 545864.03 | 3670974.33 | 8.45 | FSC |
| 545863.97 | 3670978.33 | 8.65 | TEF |
| 545863.96 | 3670979.33 | 14.01 | TPF |
| 545863.94 | 3670980.33 | 14.02 | TPF |
| 545866.17 | 3670827.34 | -1.43 | SND |
| 545866.02 | 3670837.34 | -3.33 | SND |
| 545865.88 | 3670847.34 | -3.13 | SND |
| 545865.73 | 3670857.34 | -2.03 | SND |
| 545865.59 | 3670867.34 | -1.23 | SND |
| 545865.44 | 3670877.34 | -2.53 | SND |
| 545865.30 | 3670887.34 | -4.23 | SND |
| 545865.15 | 3670897.34 | -4.43 | SND |
| 545865.00 | 3670907.33 | -5.03 | SND |
| 545864.86 | 3670917.33 | -4.53 | SND |
| 545864.71 | 3670927.33 | -5.23 | SND |
| 545864.57 | 3670937.33 | -3.13 | SND |
| 545864.42 | 3670947.33 | -1.13 | SND |

| Line Name | Location | | |
|---|---|---|---|
| **6-1** | **London Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 543778.84 | 3681331.62 | 12.67 | TPF |
| 543778.84 | 3681332.62 | 12.67 | TPF |
| 543778.84 | 3681332.62 | 5.91 | TEF |
| 543778.86 | 3681341.62 | 5.61 | HWL |
| 543778.86 | 3681341.62 | 0.61 | SLP |
| 543778.86 | 3681342.62 | 0.11 | WES |
| 543778.98 | 3681435.62 | 0.11 | WES |
| 543778.98 | 3681436.62 | 4.98 | HWL |
| 543778.98 | 3681440.62 | 12.67 | TPF |
| 543778.98 | 3681440.62 | 5.91 | TEF |
| 543778.98 | 3681441.62 | 12.67 | TPF |
| 543778.86 | 3681347.62 | -2.09 | SND |
| 543778.88 | 3681357.62 | -4.49 | SND |
| 543778.89 | 3681367.62 | -4.39 | SND |
| 543778.90 | 3681377.62 | -4.59 | SND |
| 543778.91 | 3681387.62 | -4.29 | SND |
| 543778.93 | 3681397.62 | -3.69 | SND |
| 543778.94 | 3681407.62 | -3.69 | SND |
| 543778.95 | 3681417.62 | -4.19 | SND |
| 543778.96 | 3681427.62 | -3.99 | SND |
| 543778.98 | 3681435.62 | -1.39 | SND |

| Line Name | Location | | |
|---|---|---|---|
| **8-1** | **London Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 556091.85 | 3680290.58 | 12.76 | TPF |
| 556091.86 | 3680291.58 | 12.76 | TPF |
| 556091.86 | 3680291.58 | 3.98 | TEF |
| 556091.88 | 3680293.58 | 3.78 | SLP |
| 556092.04 | 3680308.58 | 1.88 | TBK |
| 556092.06 | 3680310.58 | 0.78 | TOE |
| 556093.58 | 3680453.57 | 0.18 | TOE |
| 556093.59 | 3680454.57 | 1.38 | TOP |
| 556093.75 | 3680469.57 | 3.58 | TEF |
| 556093.75 | 3680469.57 | 12.76 | TPF |
| 556093.76 | 3680470.57 | 12.76 | TPF |
| 556092.08 | 3680312.58 | 0.20 | WES |
| 556092.09 | 3680313.58 | 0.00 | SND |
| 556092.20 | 3680323.58 | -6.00 | SND |
| 556092.31 | 3680333.58 | -10.00 | SND |
| 556092.41 | 3680343.58 | -12.20 | SND |
| 556092.52 | 3680353.58 | -11.90 | SND |
| 556092.62 | 3680363.57 | -12.70 | SND |
| 556092.73 | 3680373.57 | -11.80 | SND |
| 556092.84 | 3680383.57 | -11.80 | SND |
| 556092.94 | 3680393.57 | -11.80 | SND |
| 556093.05 | 3680403.57 | -11.40 | SND |

| | | | |
|---|---|---|---|
| 556093.16 | 3680413.57 | -11.20 | SND |
| 556093.26 | 3680423.57 | -8.60 | SND |
| 556093.37 | 3680433.57 | -3.80 | SND |
| 556093.47 | 3680443.57 | -1.90 | SND |
| 556093.58 | 3680453.57 | 0.20 | WES |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **9-1** | **London Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 556558.27 | 3680040.23 | 11.78 | CL |
| 556559.94 | 3680044.94 | 11.78 | FSC |
| 556563.28 | 3680054.36 | 8.68 | SLP |
| 556569.96 | 3680073.22 | 3.18 | FST |
| 556571.63 | 3680077.93 | 2.88 | NG |
| 556573.97 | 3680084.53 | 2.68 | TBK |
| 556575.64 | 3680089.24 | -0.02 | TOE |
| 556658.80 | 3680323.94 | 1.78 | TBK |
| 556661.80 | 3680332.43 | 2.88 | NG |
| 556668.48 | 3680351.28 | 3.98 | NG |
| 556675.16 | 3680370.13 | 4.88 | FST |
| 556680.17 | 3680384.27 | 7.98 | SLP |
| 556684.51 | 3680396.52 | 11.88 | FSC |
| 556685.85 | 3680400.29 | 11.98 | CL |
| 556578.31 | 3680096.78 | -0.78 | SND |
| 556581.65 | 3680106.21 | -1.58 | SND |
| 556584.99 | 3680115.63 | -2.38 | SND |
| 556588.33 | 3680125.06 | -2.58 | SND |
| 556591.67 | 3680134.48 | -2.58 | SND |
| 556595.01 | 3680143.91 | -2.98 | SND |
| 556598.35 | 3680153.34 | -3.78 | SND |
| 556601.69 | 3680162.76 | -4.38 | SND |
| 556605.03 | 3680172.19 | -4.98 | SND |
| 556608.37 | 3680181.61 | -5.58 | SND |
| 556611.71 | 3680191.04 | -6.78 | SND |
| 556615.05 | 3680200.46 | -7.68 | SND |
| 556618.38 | 3680209.89 | -7.68 | SND |
| 556621.72 | 3680219.32 | -8.38 | SND |
| 556625.06 | 3680228.74 | -7.88 | SND |
| 556628.40 | 3680238.17 | -8.68 | SND |
| 556631.74 | 3680247.59 | -9.28 | SND |
| 556635.08 | 3680257.02 | -9.18 | SND |
| 556638.42 | 3680266.45 | -8.88 | SND |
| 556641.76 | 3680275.87 | -9.38 | SND |
| 556645.10 | 3680285.30 | -8.18 | SND |
| 556648.44 | 3680294.72 | -7.28 | SND |
| 556651.78 | 3680304.15 | -5.18 | SND |
| 556655.12 | 3680313.57 | -1.58 | SND |
| 556657.79 | 3680321.12 | 0.22 | WES |
| 556575.97 | 3680090.18 | 0.22 | WES |

| Line Name | Location | | |
|---|---|---|---|
| **10-1** | **London Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 558496.77 | 3679210.92 | 12.57 | CL |
| 558498.24 | 3679216.73 | 12.17 | FSC |
| 558501.91 | 3679231.28 | 7.37 | SLP |
| 558504.36 | 3679240.97 | 4.07 | FST |
| 558510.49 | 3679265.21 | 2.47 | NG |
| 558512.94 | 3679274.90 | 2.17 | BSH |
| 558513.43 | 3679276.84 | 2.37 | TOP |
| 558514.41 | 3679280.72 | 1.37 | TOE |
| 558516.61 | 3679289.45 | 0.87 | TBK |
| 558564.64 | 3679479.47 | 1.67 | TBK |
| 558568.07 | 3679493.05 | 2.57 | TOE |
| 558572.23 | 3679509.53 | 4.27 | TOP |
| 558577.87 | 3679531.83 | 5.37 | NG |
| 558584.00 | 3679556.06 | 6.77 | NG |
| 558588.90 | 3679575.46 | 7.67 | FST |
| 558592.57 | 3679590.00 | 11.47 | FSC |
| 558593.55 | 3679593.88 | 11.57 | CL |
| 558519.06 | 3679299.14 | -2.16 | SND |
| 558521.51 | 3679308.84 | -4.26 | SND |
| 558523.96 | 3679318.53 | -5.96 | SND |
| 558526.41 | 3679328.23 | -8.76 | SND |
| 558528.86 | 3679337.92 | -12.56 | SND |
| 558531.32 | 3679347.62 | -13.76 | SND |
| 558533.77 | 3679357.31 | -14.36 | SND |
| 558536.22 | 3679367.01 | -14.16 | SND |
| 558538.67 | 3679376.70 | -14.16 | SND |
| 558541.12 | 3679386.40 | -14.26 | SND |
| 558543.57 | 3679396.09 | -13.16 | SND |
| 558546.02 | 3679405.79 | -11.76 | SND |
| 558548.47 | 3679415.48 | -9.26 | SND |
| 558550.92 | 3679425.18 | -5.96 | SND |
| 558553.37 | 3679434.88 | -3.26 | SND |
| 558555.82 | 3679444.57 | -1.56 | SND |
| 558558.27 | 3679454.27 | -1.36 | SND |
| 558560.72 | 3679463.96 | -1.06 | SND |
| 558562.92 | 3679472.69 | 0.24 | WES |

| Line Name | Location | | |
|---|---|---|---|
| **11-1** | **London Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 559101.55 | 3679136.03 | 6.23 | TPF |
| 559101.78 | 3679137.00 | 6.18 | TPF |
| 559102.93 | 3679141.87 | 2.98 | SLP |
| 559104.31 | 3679147.71 | 0.39 | WES |
| 559139.72 | 3679297.58 | 0.39 | WES |
| 559141.10 | 3679303.42 | 3.18 | SLP |
| 559142.48 | 3679309.26 | 6.48 | TPF |
| 559142.71 | 3679310.23 | 6.48 | TPF |
| 559139.72 | 3679297.58 | 0.39 | WES |
| 559106.15 | 3679155.50 | -2.81 | SND |
| 559106.38 | 3679156.47 | -11.01 | SND |
| 559108.68 | 3679166.20 | -12.71 | SND |
| 559110.98 | 3679175.93 | -12.61 | SND |
| 559113.28 | 3679185.66 | -12.41 | SND |
| 559115.58 | 3679195.40 | -12.31 | SND |
| 559117.88 | 3679205.13 | -12.11 | SND |
| 559120.18 | 3679214.86 | -12.11 | SND |
| 559122.48 | 3679224.59 | -12.01 | SND |
| 559124.78 | 3679234.32 | -12.01 | SND |
| 559127.08 | 3679244.06 | -12.11 | SND |
| 559129.38 | 3679253.79 | -11.71 | SND |
| 559131.68 | 3679263.52 | -11.31 | SND |
| 559133.98 | 3679273.25 | -10.61 | SND |
| 559136.28 | 3679282.98 | -9.21 | SND |
| 559138.58 | 3679292.72 | -2.21 | SND |

| Line Name | Location | | |
|---|---|---|---|
| **12-1** | **Peoples & Florida Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 543096.45 | 3688735.07 | -2.64 | CLR |
| 543094.33 | 3688748.40 | -2.74 | ER |
| 543094.25 | 3688748.90 | -2.19 | CRB |
| 543093.78 | 3688751.86 | -2.24 | TBK |
| 543092.52 | 3688759.76 | -6.84 | SLP |
| 543091.11 | 3688768.65 | -11.04 | TOE |
| 543090.48 | 3688772.60 | -11.94 | TOP |
| 543089.38 | 3688779.51 | -14.34 | WES |
| 543088.59 | 3688784.45 | -17.34 | WB |
| 543087.18 | 3688793.34 | -20.34 | CL |
| 543085.92 | 3688801.24 | -19.84 | WB |
| 543084.98 | 3688807.16 | -14.34 | WES |
| 543083.88 | 3688814.08 | -12.04 | SLP |
| 543082.94 | 3688820.00 | -9.74 | TC |
| 543080.74 | 3688833.83 | -7.94 | SLP |
| 543078.54 | 3688847.65 | -3.94 | SLP |
| 543076.81 | 3688858.52 | 0.96 | TBK |

| Line Name | Location | | |
|---|---|---|---|
| **13-1** | **Peoples Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 546116.13 | 3688561.36 | -2.42 | TER |
| 546116.51 | 3688575.35 | -3.62 | TBK |
| 546116.81 | 3688586.35 | -8.62 | TC |
| 546117.03 | 3688594.34 | -12.04 | WES |
| 546117.14 | 3688598.34 | -13.32 | SND |
| 546117.46 | 3688610.34 | -14.82 | CL |
| 546117.68 | 3688618.33 | -16.04 | SND |
| 546117.79 | 3688622.33 | -12.02 | WES |
| 546117.96 | 3688628.33 | -9.82 | TC |
| 546118.12 | 3688634.33 | -8.82 | SLP |
| 546118.50 | 3688648.32 | -5.32 | SLP |
| 546118.64 | 3688653.32 | -4.52 | TBK |
| 546118.94 | 3688664.32 | -3.72 | TER |

| Line Name | Location | | |
|---|---|---|---|
| **14-1** | **Peoples Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 546337.38 | 3688551.58 | -2.79 | NG |
| 546338.07 | 3688554.50 | -3.19 | TBK |
| 546339.45 | 3688560.34 | -5.99 | SLP |
| 546340.83 | 3688566.18 | -8.49 | TOE |
| 546341.06 | 3688567.15 | -8.09 | TPF |
| 546341.17 | 3688567.64 | -8.09 | TPF |
| 546341.17 | 3688567.64 | -12.79 | WES |
| 546341.17 | 3688567.64 | -13.99 | TOE |
| 546343.12 | 3688575.91 | -14.99 | WB |
| 546345.88 | 3688587.59 | -17.79 | CL |
| 546348.41 | 3688598.30 | -17.09 | WB |
| 546349.56 | 3688603.16 | -12.79 | WES |
| 546349.79 | 3688604.13 | -11.99 | SLP |
| 546351.63 | 3688611.92 | -9.19 | TPF |
| 546352.78 | 3688616.79 | -7.69 | SLP |
| 546354.61 | 3688624.57 | -4.79 | TBK |

| Line Name | Location | | |
|---|---|---|---|
| **15-1** | **Peoples Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 546816.90 | 3688506.36 | -3.32 | CLR |
| 546817.64 | 3688516.33 | -3.92 | ER |
| 546817.86 | 3688519.32 | -3.72 | TBK |
| 546818.38 | 3688526.30 | -5.62 | SLP |
| 546819.12 | 3688536.27 | -8.42 | SLP |
| 546819.71 | 3688544.25 | -10.72 | TOE |
| 546819.74 | 3688544.75 | -10.92 | TPF |
| 546819.78 | 3688545.25 | -10.92 | TPF |
| 546819.78 | 3688545.25 | -12.77 | WES |

| | | | |
|---|---|---|---|
| 546819.85 | 3688546.25 | -16.82 | TOE |
| 546820.22 | 3688551.23 | -16.92 | CL |
| 546820.63 | 3688556.72 | -16.72 | TOE |
| 546820.63 | 3688556.72 | -12.77 | WES |
| 546820.63 | 3688556.72 | -11.02 | TPF |
| 546820.67 | 3688557.22 | -11.02 | TPF |
| 546820.82 | 3688559.21 | -10.82 | TOE |
| 546821.55 | 3688569.18 | -8.42 | SLP |
| 546822.81 | 3688586.14 | -4.22 | SLP |
| 546823.77 | 3688599.10 | -1.32 | TBK |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **16-1** | **Peoples Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 546964.83 | 3688494.16 | -3.19 | DRV |
| 546965.83 | 3688501.09 | -3.46 | ER |
| 546966.11 | 3688503.07 | -3.86 | TBK |
| 546968.39 | 3688518.90 | -8.06 | SLP |
| 546970.10 | 3688530.78 | -10.86 | TOE |
| 546970.39 | 3688532.76 | -10.96 | TOP |
| 546970.53 | 3688533.75 | -11.06 | TOP |
| 546970.53 | 3688533.75 | -12.73 | WES |
| 546970.53 | 3688533.75 | -16.76 | TOE |
| 546970.53 | 3688533.75 | -16.96 | CL |
| 546972.03 | 3688544.14 | -16.96 | TOE |
| 546972.03 | 3688544.14 | -12.73 | WES |
| 546972.03 | 3688544.14 | -11.06 | TPF |
| 546972.10 | 3688544.64 | -11.06 | TPF |
| 546972.24 | 3688545.63 | -11.16 | TOE |
| 546975.52 | 3688568.39 | -6.06 | SLP |
| 546976.38 | 3688574.33 | -4.19 | SLP |
| 546977.94 | 3688585.22 | -0.49 | SLP |
| 546979.80 | 3688598.09 | 1.21 | TBK |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **17-1** | **Peoples Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 548619.26 | 3688368.40 | 0.66 | NG |
| 548618.84 | 3688374.39 | 0.46 | TBK |
| 548618.28 | 3688382.37 | -3.04 | SLP |
| 548617.51 | 3688393.34 | -5.74 | SLP |
| 548616.66 | 3688405.31 | -9.94 | TOE |
| 548616.52 | 3688407.30 | -10.34 | TPF |
| 548616.45 | 3688408.30 | -10.34 | TPF |
| 548616.45 | 3688408.30 | -11.79 | WES |
| 548616.45 | 3688408.30 | -14.84 | TOE |
| 548616.10 | 3688413.29 | -14.24 | CL |
| 548615.68 | 3688419.27 | -14.34 | TOE |
| 548615.68 | 3688419.27 | -11.79 | WES |

| | | | |
|---|---|---|---|
| 548615.68 | 3688419.27 | -8.24 | TPF |
| 548615.61 | 3688420.27 | -10.24 | TPF |
| 548615.33 | 3688424.26 | -9.34 | SLP |
| 548614.35 | 3688438.23 | -5.34 | SLP |
| 548613.64 | 3688448.20 | -1.04 | SLP |
| 548612.80 | 3688460.17 | 4.16 | SLP |
| 548612.24 | 3688468.15 | 6.79 | SLP |
| 548611.75 | 3688475.14 | 9.89 | TBK |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **19-1** | **Florida Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 541565.64 | 3693462.77 | -4.19 | TER |
| 541554.17 | 3693459.23 | -5.39 | NG |
| 541538.89 | 3693454.50 | -6.09 | TBK |
| 541530.29 | 3693451.84 | -7.69 | SLP |
| 541518.83 | 3693448.29 | -9.89 | TOE |
| 541512.14 | 3693446.23 | -10.49 | TOP |
| 541508.32 | 3693445.04 | -11.69 | TPF |
| 541507.84 | 3693444.90 | -12.49 | TPF |
| 541507.84 | 3693444.90 | -14.20 | WES |
| 541507.84 | 3693444.90 | -19.09 | TOE |
| 541496.85 | 3693441.50 | -19.19 | CL |
| 541483.48 | 3693437.36 | -18.39 | TOE |
| 541483.48 | 3693437.36 | -14.20 | WES |
| 541483.48 | 3693437.36 | -12.39 | TPF |
| 541482.52 | 3693437.07 | -12.39 | TPF |
| 541480.61 | 3693436.48 | -11.09 | SLP |
| 541477.75 | 3693435.59 | -9.79 | TOP |
| 541467.24 | 3693432.34 | -8.69 | SLP |
| 541448.13 | 3693426.43 | -4.19 | TBK |

| **Line Name** | **Location** | | |
|---|---|---|---|
| **20-1** | **Florida Ave. Canal** | | |
| **Northing** | **Easting** | **Elevation (ft)** | **Description** |
| 541196.81 | 3694913.33 | -3.11 | SLP |
| 541187.41 | 3694909.91 | -4.31 | SLP |
| 541170.49 | 3694903.76 | -6.01 | TBK |
| 541163.91 | 3694901.37 | -7.91 | SLP |
| 541150.76 | 3694896.59 | -11.11 | TOE |
| 541149.82 | 3694896.24 | -11.45 | TPF |
| 541148.88 | 3694895.90 | -11.47 | TPF |
| 541148.88 | 3694895.90 | -14.16 | WES |
| 541148.88 | 3694895.90 | -20.41 | TOE |
| 541135.72 | 3694891.12 | -20.41 | CL |
| 541122.56 | 3694886.34 | -20.41 | TOE |
| 541122.56 | 3694886.34 | -14.16 | WES |
| 541122.56 | 3694886.34 | -11.67 | TPF |
| 541121.62 | 3694886.00 | -11.67 | TPF |

| | | | |
|---|---|---|---|
| 541116.92 | 3694884.29 | -10.21 | SLP |
| 541102.82 | 3694879.16 | -7.81 | SLP |
| 541093.43 | 3694875.75 | -6.41 | SLP |
| 541079.33 | 3694870.62 | -4.41 | TBK |
| 541069.93 | 3694867.21 | -3.31 | NG |

# Appendix 3
# Topographic and Hydrographic Cross Section Data

## St. Bernard Parish (Areas 2 and 3)

**AREA 2**

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**AREA 2 : TYPICAL SECTION AT 1**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 1 | 532454.88 | 3718795.74 | -3.82 | TBK |
| 2 | 532449.36 | 3718793.40 | -6.02 | SLP |
| 3 | 532445.68 | 3718791.83 | -7.22 | WE |
| 4 | 532435.55 | 3718787.54 | -9.42 | CB |
| 5 | 532417.14 | 3718779.72 | -10.42 | CB |
| 6 | 532398.73 | 3718771.91 | -11.42 | CB |
| 7 | 532380.32 | 3718764.09 | -10.92 | CB |
| 8 | 532361.91 | 3718756.28 | -10.52 | CB |
| 9 | 532351.78 | 3718751.98 | -9.92 | CB |
| 10 | 532339.82 | 3718746.90 | -7.22 | WE |
| 11 | 532332.45 | 3718743.77 | -2.82 | TBK |

**AREA 2 : TYPICAL SECTION AT 2**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 12 | 532336.16 | 3719090.60 | -3.93 | TBK |
| 13 | 532330.63 | 3719088.25 | -5.63 | SLP |
| 14 | 532326.03 | 3719086.30 | -7.23 | WE |
| 15 | 532314.98 | 3719081.61 | -8.23 | CB |
| 16 | 532305.78 | 3719077.70 | -11.33 | CB |
| 17 | 532287.37 | 3719069.89 | -11.53 | CB |
| 18 | 532268.96 | 3719062.08 | -10.33 | CB |
| 19 | 532250.55 | 3719054.26 | -11.33 | CB |
| 20 | 532232.14 | 3719046.45 | -11.53 | CB |
| 21 | 532213.73 | 3719038.63 | -9.03 | CB |
| 22 | 532199.00 | 3719032.38 | -7.23 | WE |

| | | | | |
|---|---|---|---|---|
| 23 | 532192.56 | 3719029.64 | -4.33 | TBK |

**AREA 2 : TYPICAL SECTION AT 3**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 24 | 531320.75 | 3721621.25 | -4.66 | TBK |
| 25 | 531309.62 | 3721616.75 | -7.16 | WE |
| 26 | 531291.08 | 3721609.26 | -8.46 | CB |
| 27 | 531272.54 | 3721601.77 | -9.86 | CB |
| 28 | 531253.99 | 3721594.28 | -10.96 | CB |
| 29 | 531235.45 | 3721586.79 | -12.36 | CB |
| 30 | 531216.91 | 3721579.29 | -12.16 | CB |
| 31 | 531205.78 | 3721574.80 | -7.16 | WE |
| 32 | 531203.93 | 3721574.05 | -5.56 | SLP |
| 33 | 531197.43 | 3721571.43 | -3.86 | TBK |

**AREA 2 : TYPICAL SECTION AT 4**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 34 | 531253.70 | 3721834.56 | -2.11 | TBK |
| 35 | 531244.37 | 3721828.73 | -4.91 | SLP |
| 36 | 531235.89 | 3721823.43 | -7.21 | WE |
| 37 | 531219.78 | 3721813.36 | -10.81 | CB |
| 38 | 531202.82 | 3721802.76 | -13.61 | CB |
| 39 | 531185.86 | 3721792.16 | -13.51 | CB |
| 40 | 531168.90 | 3721781.56 | -12.11 | CB |
| 41 | 531151.94 | 3721770.96 | -9.41 | CB |
| 42 | 531134.97 | 3721760.37 | -7.21 | WE |
| 43 | 531132.43 | 3721758.78 | -5.51 | SLP |
| 44 | 531129.04 | 3721756.66 | -3.91 | TBK |

**AREA 2 : TYPICAL SECTION AT 5**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 45 | 529982.01 | 3725017.92 | -1.68 | TBK |
| 46 | 529975.72 | 3725014.85 | -3.98 | SLP |
| 47 | 529970.33 | 3725012.22 | -6.48 | SLP |
| 48 | 529964.93 | 3725009.59 | -7.08 | WE |
| 49 | 529946.06 | 3725000.39 | -8.58 | CB |
| 50 | 529928.08 | 3724991.62 | -9.98 | CB |
| 51 | 529910.11 | 3724982.85 | -16.08 | CB |
| 52 | 529892.13 | 3724974.09 | -15.08 | CB |
| 53 | 529874.16 | 3724965.32 | -8.48 | CB |
| 54 | 529870.56 | 3724963.56 | -7.08 | WE |
| 55 | 529861.57 | 3724959.18 | -4.18 | SLP |
| 56 | 529855.28 | 3724956.11 | -1.88 | TBK |

**AREA 2 : TYPICAL SECTION AT 6**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 57 | 529840.01 | 3725354.44 | -4.05 | TBK |
| 58 | 529833.67 | 3725351.48 | -7.25 | WE |
| 59 | 529821.88 | 3725345.99 | -9.15 | CB |
| 60 | 529803.76 | 3725337.54 | -9.65 | CB |
| 61 | 529785.63 | 3725329.09 | -13.15 | CB |
| 62 | 529767.51 | 3725320.63 | -15.25 | CB |
| 63 | 529749.38 | 3725312.18 | -13.25 | CB |
| 64 | 529726.72 | 3725301.62 | -7.85 | CB |

| | | | | |
|---|---|---|---|---|
| 65 | 529725.82 | 3725301.19 | -7.25 | WE |
| 66 | 529717.66 | 3725297.39 | -1.65 | TBK |

**AREA 2 : TYPICAL SECTION AT 7**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 67 | 531674.27 | 3716712.47 | 0.31 | TBK |
| 68 | 531667.78 | 3716709.84 | -2.99 | SLP |
| 69 | 531663.14 | 3716707.97 | -7.29 | WE |
| 70 | 531653.87 | 3716704.22 | -7.99 | CB |
| 71 | 531642.74 | 3716699.73 | -8.39 | CB |
| 72 | 531630.69 | 3716694.86 | -8.49 | CB |
| 73 | 531626.98 | 3716693.36 | -7.29 | WE |
| 74 | 531621.42 | 3716691.11 | -6.39 | SLP |
| 75 | 531612.15 | 3716687.37 | -5.49 | SLP |
| 76 | 531604.73 | 3716684.37 | -0.59 | TBK |

**AREA 2 : TYPICAL SECTION AT 8**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 77 | 531048.54 | 3718193.76 | -4.09 | TBK |
| 78 | 531046.60 | 3718197.26 | -4.99 | SLP |
| 79 | 531044.66 | 3718200.76 | -7.09 | WE |
| 80 | 531041.27 | 3718206.88 | -11.79 | CB |
| 81 | 531036.91 | 3718214.75 | -11.49 | CB |
| 82 | 531028.66 | 3718229.62 | -11.49 | CB |
| 83 | 531028.18 | 3718230.50 | -8.79 | CB |
| 84 | 531025.76 | 3718234.87 | -7.09 | WE |
| 85 | 531023.82 | 3718238.37 | -4.59 | SLP |
| 86 | 531021.39 | 3718242.74 | -2.99 | TBK |

**AREA 2 : TYPICAL SECTION AT 9**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 87 | 527033.32 | 3716142.59 | 1.32 | TBK |
| 88 | 527029.82 | 3716150.81 | -3.52 | SLP |
| 89 | 527027.94 | 3716154.13 | -6.25 | TOE |
| 90 | 527027.17 | 3716157.67 | -6.82 | CL DITCH |
| 91 | 527025.62 | 3716160.02 | -6.67 | TOE |
| 92 | 527023.42 | 3716163.20 | -3.65 | SLP |
| 93 | 527022.70 | 3716164.93 | -3.18 | SLP |
| 94 | 527017.88 | 3716172.37 | 1.72 | TBK |

**AREA 2 : TYPICAL SECTION AT 12**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 95 | 531027.08 | 3718139.88 | -3.37 | TBK |
| 96 | 531024.38 | 3718138.57 | -4.47 | SLP |
| 97 | 531019.89 | 3718136.37 | -7.27 | WE |
| 98 | 531018.09 | 3718135.50 | -8.57 | CB |
| 99 | 531014.49 | 3718133.74 | -9.37 | CB |
| 100 | 531011.80 | 3718132.43 | -9.47 | CB |
| 101 | 531010.90 | 3718131.99 | -8.07 | CB |
| 102 | 531009.10 | 3718131.11 | -7.27 | WE |
| 103 | 531006.41 | 3718129.80 | -4.97 | SLP |
| 104 | 531004.61 | 3718128.92 | -3.67 | TBK |

**AREA 2 : TYPICAL SECTION AT 13**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 105 | 530946.42 | 3718146.76 | -4.42 | TBK |
| 106 | 530945.10 | 3718149.45 | -5.52 | SLP |
| 107 | 530943.79 | 3718152.15 | -7.22 | WE |
| 108 | 530942.91 | 3718153.95 | -10.62 | CB |
| 109 | 530938.09 | 3718163.83 | -11.72 | CB |
| 110 | 530931.95 | 3718176.42 | -10.92 | CB |
| 111 | 530928.88 | 3718182.71 | -7.22 | WE |
| 112 | 530926.25 | 3718188.10 | -4.32 | SLP |
| 113 | 530924.06 | 3718192.59 | -2.12 | TBK |

**AREA 2 : TYPICAL SECTION AT 14**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 114 | 532223.15 | 3718841.36 | -4.46 | TBK |
| 115 | 532224.56 | 3718838.71 | -5.86 | SLP |
| 116 | 532225.97 | 3718836.06 | -7.26 | WE |
| 117 | 532227.85 | 3718832.53 | -11.06 | CB |
| 118 | 532233.95 | 3718821.05 | -13.66 | CB |
| 119 | 532241.46 | 3718806.93 | -12.46 | CB |
| 120 | 532243.81 | 3718802.51 | -7.26 | WE |
| 121 | 532246.63 | 3718797.22 | -4.06 | TBK |

**AREA 2 : TYPICAL SECTION AT 15**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 122 | 522670.74 | 3717726.32 | 6.93 | TBK |
| 123 | 522667.14 | 3717732.16 | 2.31 | TOE |
| 124 | 522666.09 | 3717734.94 | 1.95 | CL DITCH |
| 125 | 522665.18 | 3717736.98 | 2.31 | TOE |
| 126 | 522662.55 | 3717743.46 | 6.81 | TBK |

**AREA 2 : TYPICAL SECTION AT 17**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 127 | 523096.43 | 3717906.31 | 5.35 | TBK |
| 128 | 523093.24 | 3717913.64 | 2.45 | TD |
| 129 | 523090.85 | 3717919.15 | 1.95 | CLD |
| 130 | 523089.25 | 3717922.82 | 2.65 | TD |
| 131 | 523085.66 | 3717931.07 | 5.65 | TBK |

**AREA 2 : TYPICAL SECTION AT 20**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 132 | 527438.25 | 3719911.63 | -1.12 | TBK |
| 133 | 527435.34 | 3719918.00 | -3.52 | SLP |
| 134 | 527432.85 | 3719923.46 | -7.42 | WE |
| 135 | 527432.44 | 3719924.37 | -8.62 | CB |
| 136 | 527430.78 | 3719928.01 | -9.22 | CB |
| 137 | 527429.12 | 3719931.65 | -8.82 | CB |
| 138 | 527428.71 | 3719932.56 | -7.42 | WE |
| 139 | 527425.81 | 3719938.93 | -4.02 | SLP |
| 140 | 527423.73 | 3719943.48 | -1.12 | TBK |

**AREA 2 : TYPICAL SECTION AT 21**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 141 | 527583.40 | 3719959.44 | -0.95 | TBK |
| 142 | 527581.05 | 3719963.85 | -2.75 | SLP |
| 143 | 527578.23 | 3719969.15 | -6.05 | TOE |
| 144 | 527572.60 | 3719979.74 | -6.65 | TOP |
| 145 | 527572.13 | 3719980.63 | -7.25 | WE |
| 146 | 527571.19 | 3719982.39 | -9.65 | CB |
| 147 | 527568.37 | 3719987.69 | -11.05 | CB |
| 148 | 527562.74 | 3719998.29 | -9.15 | CB |
| 149 | 527561.33 | 3720000.94 | -7.25 | WE |
| 150 | 527558.98 | 3720005.35 | -3.35 | SLP |
| 151 | 527557.57 | 3720008.00 | -0.95 | TBK |

**AREA 2 : TYPICAL SECTION AT 21A**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 152 | 527549.95 | 3719830.77 | -0.95 | TBK |
| 153 | 527543.98 | 3719831.34 | -4.36 | SLP |
| 154 | 527536.02 | 3719832.11 | -6.66 | SLP |
| 155 | 527529.05 | 3719832.78 | -8.26 | WE |
| 156 | 527527.06 | 3719832.97 | -9.46 | CB |
| 157 | 527521.09 | 3719833.55 | -10.26 | CB |
| 158 | 527516.11 | 3719834.03 | -10.46 | CB |
| 159 | 527514.12 | 3719834.22 | -8.26 | WE |
| 160 | 527510.14 | 3719834.60 | -4.55 | SLP |
| 161 | 527506.15 | 3719834.99 | -1.75 | TBK |

**AREA 2 : TYPICAL SECTION AT 31**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 162 | 529717.84 | 3725084.31 | -2.62 | TBK |
| 163 | 529719.87 | 3725079.74 | -4.62 | SLP |
| 164 | 529720.69 | 3725077.92 | -7.02 | WE |
| 165 | 529721.91 | 3725075.18 | -9.02 | CB |
| 166 | 529728.01 | 3725061.47 | -11.72 | CB |
| 167 | 529735.33 | 3725045.03 | -9.12 | CB |
| 168 | 529737.36 | 3725040.46 | -7.02 | WE |
| 169 | 529738.58 | 3725037.72 | -3.22 | TBK |

**AREA 2 : TYPICAL SECTION AT 35**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 170 | 524394.24 | 3729001.22 | -3.48 | TBK |
| 171 | 524387.71 | 3728998.72 | -7.28 | WE |
| 172 | 524380.24 | 3728995.85 | -10.28 | CB |
| 173 | 524370.91 | 3728992.26 | -11.08 | CB |
| 174 | 524357.84 | 3728987.25 | -8.98 | CB |
| 175 | 524353.17 | 3728985.46 | -7.28 | WE |
| 176 | 524346.63 | 3728982.95 | -4.08 | SLP |
| 177 | 524340.10 | 3728980.44 | -1.88 | TBK |

**AREA 2 : TYPICAL SECTION AT 36**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 178 | 524284.92 | 3729082.61 | -2.69 | TBK |
| 179 | 524288.72 | 3729085.86 | -6.59 | WE |
| 180 | 524294.80 | 3729091.05 | -11.09 | CB |

| | | | | |
|---|---|---|---|---|
| 181 | 524303.93 | 3729098.84 | -11.69 | CB |
| 182 | 524313.81 | 3729107.29 | -11.49 | CB |
| 183 | 524320.66 | 3729113.13 | -6.59 | WE |
| 184 | 524325.98 | 3729117.68 | -3.49 | SLP |
| 185 | 524329.78 | 3729120.93 | -1.99 | TBK |

**AREA 2 : TYPICAL SECTION AT 37**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 186 | 524280.24 | 3729017.19 | -1.93 | TBK |
| 187 | 524282.89 | 3729014.19 | -3.13 | SLP |
| 188 | 524286.21 | 3729010.44 | -7.33 | WE |
| 189 | 524286.87 | 3729009.70 | -8.93 | CB |
| 190 | 524289.52 | 3729006.70 | -8.73 | CB |
| 191 | 524295.48 | 3728999.96 | -8.43 | CB |
| 192 | 524296.15 | 3728999.21 | -7.33 | WE |
| 193 | 524300.12 | 3728994.72 | -2.33 | TBK |

**AREA 2 : TYPICAL SECTION AT 38**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 194 | 521647.72 | 3726838.13 | 3.11 | TBK |
| 195 | 521652.10 | 3726832.88 | -1.00 | TOE |
| 196 | 521655.75 | 3726828.70 | -0.52 | CL DITCH |
| 197 | 521659.60 | 3726824.19 | -0.31 | TOE |
| 198 | 521663.25 | 3726820.15 | 3.20 | TBK |

**AREA 2 : TYPICAL SECTION AT 39**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 199 | 524412.87 | 3729056.39 | -1.44 | TBK |
| 200 | 524408.61 | 3729061.95 | -4.04 | SLP |
| 201 | 524402.52 | 3729069.88 | -7.24 | WE |
| 202 | 524395.22 | 3729079.40 | -9.94 | CB |
| 203 | 524389.13 | 3729087.34 | -11.94 | CB |
| 204 | 524376.35 | 3729104.00 | -10.44 | CB |
| 205 | 524371.48 | 3729110.34 | -7.24 | WE |
| 206 | 524367.83 | 3729115.10 | -4.24 | SLP |
| 207 | 524363.56 | 3729120.66 | -2.54 | TBK |

**AREA 2 : TYPICAL SECTION AT 40**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 208 | 527332.95 | 3731688.77 | -4.72 | TBK |
| 209 | 527327.49 | 3731686.29 | -6.12 | SLP |
| 210 | 527316.57 | 3731681.31 | -7.92 | WE |
| 211 | 527300.19 | 3731673.85 | -10.22 | CB |
| 212 | 527281.99 | 3731665.55 | -10.22 | CB |
| 213 | 527263.79 | 3731657.26 | -10.92 | CB |
| 214 | 527245.59 | 3731648.96 | -13.62 | CB |
| 215 | 527227.39 | 3731640.67 | -14.92 | CB |
| 216 | 527218.29 | 3731636.52 | -12.92 | CB |
| 217 | 527211.92 | 3731633.62 | -8.52 | CB |
| 218 | 527211.01 | 3731633.21 | -3.12 | TPF |

**AREA 2 : TYPICAL SECTION AT 41**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 219 | 527194.16 | 3731378.45 | -1.39 | TBK |
| 220 | 527190.55 | 3731383.24 | -4.79 | SLP |
| 221 | 527186.94 | 3731388.03 | -7.49 | WE |
| 222 | 527183.93 | 3731392.03 | -13.09 | CB |
| 223 | 527171.90 | 3731408.00 | -13.89 | CB |
| 224 | 527159.86 | 3731423.97 | -14.19 | CB |
| 225 | 527147.82 | 3731439.95 | -9.49 | CB |
| 226 | 527144.82 | 3731443.94 | -7.49 | WE |
| 227 | 527141.81 | 3731447.93 | -5.09 | TBK |

**AREA 2 : TYPICAL SECTION AT 43**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 228 | 523681.25 | 3734815.97 | -4.44 | TBK |
| 229 | 523674.36 | 3734804.95 | -7.44 | WE |
| 230 | 523666.94 | 3734793.07 | -9.44 | CB |
| 231 | 523656.34 | 3734776.11 | -13.24 | CB |
| 232 | 523645.74 | 3734759.15 | -16.74 | CB |
| 233 | 523635.15 | 3734742.19 | -15.34 | CB |
| 234 | 523624.55 | 3734725.23 | -15.04 | CB |
| 235 | 523613.95 | 3734708.27 | -10.24 | CB |
| 236 | 523607.59 | 3734698.09 | -7.44 | WE |
| 237 | 523604.94 | 3734693.85 | -3.84 | TBK |

**AREA 2 : TYPICAL SECTION AT 44**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 238 | 519924.69 | 3737279.88 | -0.55 | TBK |
| 239 | 519917.93 | 3737265.38 | -11.65 | SLP |
| 240 | 519914.55 | 3737258.13 | -7.45 | WE |
| 241 | 519911.59 | 3737251.78 | -11.45 | CB |
| 242 | 519903.14 | 3737233.66 | -15.25 | CB |
| 243 | 519894.68 | 3737215.53 | -16.95 | CB |
| 244 | 519886.23 | 3737197.41 | -10.25 | CB |
| 245 | 519883.27 | 3737191.06 | -7.45 | WE |
| 246 | 519879.05 | 3737182.00 | -4.25 | SLP |
| 247 | 519875.67 | 3737174.75 | -0.65 | TBK |

**AREA 2 : TYPICAL SECTION AT 45**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 248 | 519622.87 | 3737572.07 | 0.77 | TBK |
| 249 | 519631.07 | 3737566.33 | -2.03 | SLP |
| 250 | 519637.62 | 3737561.75 | -7.43 | WE |
| 251 | 519640.90 | 3737559.45 | -9.83 | CB |
| 252 | 519657.28 | 3737547.98 | -13.83 | CB |
| 253 | 519673.66 | 3737536.51 | -14.13 | CB |
| 254 | 519690.05 | 3737525.04 | -13.73 | CB |
| 255 | 519706.43 | 3737513.56 | -12.53 | CB |
| 256 | 519722.81 | 3737502.09 | -7.43 | WE |
| 257 | 519726.09 | 3737499.80 | -4.13 | SLP |
| 258 | 519733.46 | 3737494.64 | -0.03 | TBK |

**AREA 2 : TYPICAL SECTION AT 46**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 259 | 519377.27 | 3737371.72 | -1.55 | TBK |
| 260 | 519381.46 | 3737369.00 | -4.25 | SLP |
| 261 | 519384.82 | 3737366.82 | -7.45 | WE |
| 262 | 519390.69 | 3737363.00 | -10.85 | CB |
| 263 | 519407.46 | 3737352.11 | -13.85 | CB |
| 264 | 519424.23 | 3737341.22 | -14.15 | CB |
| 265 | 519432.62 | 3737335.77 | -9.45 | CB |
| 266 | 519437.65 | 3737332.50 | -7.45 | WE |
| 267 | 519439.33 | 3737331.42 | -4.75 | SLP |
| 268 | 519444.36 | 3737328.15 | -1.55 | TBK |

**AREA 2 : TYPICAL SECTION AT 47**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 269 | 517669.01 | 3735318.12 | -2.12 | TBK |
| 270 | 517671.58 | 3735321.19 | -3.07 | SLP |
| 271 | 517674.15 | 3735324.25 | -7.37 | WE |
| 272 | 517678.01 | 3735328.85 | -9.47 | CB |
| 273 | 517686.36 | 3735338.80 | -11.27 | CB |
| 274 | 517694.08 | 3735348.00 | -9.57 | CB |
| 275 | 517700.50 | 3735355.66 | -7.37 | WE |
| 276 | 517703.72 | 3735359.49 | -4.27 | SLP |
| 277 | 517706.29 | 3735362.55 | -2.47 | TBK |

**AREA 2 : TYPICAL SECTION AT 49**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 278 | 517657.80 | 3735495.37 | -1.15 | TBK |
| 279 | 517662.26 | 3735491.36 | -3.95 | SLP |
| 280 | 517665.98 | 3735488.01 | -7.35 | WE |
| 281 | 517674.89 | 3735479.98 | -10.35 | CB |
| 282 | 517686.78 | 3735469.28 | -12.65 | CB |
| 283 | 517697.93 | 3735459.24 | -11.65 | CB |
| 284 | 517705.36 | 3735452.55 | -7.35 | WE |
| 285 | 517709.82 | 3735448.53 | -4.05 | SLP |
| 286 | 517716.51 | 3735442.51 | -0.45 | TBK |

**AREA 2 : TYPICAL SECTION AT 50**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 287 | 517565.75 | 3735497.34 | -1.46 | TBK |
| 288 | 517561.16 | 3735492.06 | -4.46 | SLP |
| 289 | 517557.88 | 3735488.28 | -7.36 | WE |
| 290 | 517553.94 | 3735483.75 | -9.36 | CB |
| 291 | 517547.38 | 3735476.21 | -10.56 | CB |
| 292 | 517539.51 | 3735467.15 | -10.06 | CB |
| 293 | 517532.95 | 3735459.60 | -7.36 | WE |
| 294 | 517530.32 | 3735456.58 | -4.36 | SLP |
| 295 | 517525.08 | 3735450.55 | -1.96 | TBK |

**AREA 2 : TYPICAL SECTION AT 51**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 296 | 517589.68 | 3735308.70 | 0.10 | TBK |
| 297 | 517584.48 | 3735313.38 | -3.40 | SLP |
| 298 | 517580.02 | 3735317.39 | -8.10 | WE |

| | | | | |
|---|---|---|---|---|
| 299 | 517579.27 | 3735318.06 | -9.30 | CB |
| 300 | 517577.05 | 3735320.07 | -9.70 | CB |
| 301 | 517573.33 | 3735323.42 | -9.40 | CB |
| 302 | 517571.84 | 3735324.76 | -8.10 | WE |
| 303 | 517568.87 | 3735327.43 | -4.40 | SLP |
| 304 | 517564.41 | 3735331.45 | -2.10 | TBK |

**AREA 2 : TYPICAL SECTION AT 52**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 305 | 515692.91 | 3733243.86 | 2.86 | TBK |
| 306 | 515689.05 | 3733247.04 | 1.46 | SLP |
| 307 | 515686.73 | 3733248.95 | -0.64 | TOE |
| 308 | 515684.42 | 3733250.86 | -0.74 | CLD |
| 309 | 515682.88 | 3733252.13 | -0.74 | TOE |
| 310 | 515680.56 | 3733254.04 | 1.36 | SLP |
| 311 | 515679.02 | 3733255.31 | 2.36 | TBK |

**AREA 2 : TYPICAL SECTION AT 54**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 312 | 519393.13 | 3737568.36 | 0.01 | TBK |
| 313 | 519387.63 | 3737554.40 | -3.29 | SLP |
| 314 | 519382.50 | 3737541.38 | -7.49 | WE |
| 315 | 519380.66 | 3737536.72 | -9.49 | CB |
| 316 | 519373.33 | 3737518.12 | -11.29 | CB |
| 317 | 519366.00 | 3737499.51 | -10.49 | CB |
| 318 | 519364.54 | 3737495.79 | -9.29 | CB |
| 319 | 519363.07 | 3737492.06 | -7.49 | WE |
| 320 | 519360.14 | 3737484.62 | -6.09 | SLP |
| 321 | 519353.18 | 3737466.94 | -2.29 | SLP |
| 322 | 519347.31 | 3737452.06 | 0.01 | TBK |

**AREA 2 : TYPICAL SECTION AT 55**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 323 | 515213.58 | 3740286.62 | -3.20 | TBK |
| 324 | 515209.21 | 3740278.75 | -6.60 | SLP |
| 325 | 515204.37 | 3740270.00 | -7.30 | WE |
| 326 | 515197.58 | 3740257.75 | -9.10 | CB |
| 327 | 515187.88 | 3740240.26 | -8.90 | CB |
| 328 | 515178.19 | 3740222.77 | -9.00 | CB |
| 329 | 515168.49 | 3740205.28 | -9.60 | CB |
| 330 | 515158.79 | 3740187.78 | -8.60 | CB |
| 331 | 515153.46 | 3740178.16 | -7.30 | WE |
| 332 | 515151.52 | 3740174.67 | -4.80 | SLP |
| 333 | 515150.55 | 3740172.92 | -3.80 | TBK |

**AREA 2 : TYPICAL SECTION AT 56**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 334 | 514937.58 | 3740298.65 | -3.45 | TBK |
| 335 | 514945.73 | 3740294.85 | -7.25 | WE |
| 336 | 514946.64 | 3740294.42 | -7.85 | CB |
| 337 | 514956.61 | 3740289.78 | -9.85 | CB |
| 338 | 514959.33 | 3740288.51 | -8.75 | CB |
| 339 | 514960.23 | 3740288.09 | -7.25 | WE |
| 340 | 514967.49 | 3740284.70 | -3.05 | TBK |

**AREA 2 : TYPICAL SECTION AT 59**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 341 | 514873.17 | 3740527.29 | -4.13 | TBK |
| 342 | 514865.99 | 3740511.88 | -7.23 | WE |
| 343 | 514857.53 | 3740493.76 | -8.23 | CB |
| 344 | 514849.08 | 3740475.63 | -8.63 | CB |
| 345 | 514840.63 | 3740457.51 | -9.23 | CB |
| 346 | 514832.18 | 3740439.38 | -9.53 | CB |
| 347 | 514823.72 | 3740421.25 | -9.23 | CB |
| 348 | 514815.27 | 3740403.13 | -8.93 | CB |
| 349 | 514812.31 | 3740396.78 | -7.23 | WE |
| 350 | 514809.78 | 3740391.35 | -4.43 | TBK |

**AREA 2 : TYPICAL SECTION AT 60**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 351 | 512796.23 | 3738069.03 | -2.60 | TBK |
| 352 | 512794.51 | 3738065.42 | -4.80 | TOE |
| 353 | 512788.91 | 3738053.68 | -5.00 | CLD |
| 354 | 512783.31 | 3738041.95 | -4.90 | TOE |
| 355 | 512780.73 | 3738036.53 | -1.60 | TBK |

**AREA 2 : TYPICAL SECTION AT 64**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 356 | 525438.40 | 3721455.06 | 2.07 | TBK |
| 357 | 525438.83 | 3721460.87 | -1.10 | TOE |
| 358 | 525435.70 | 3721465.99 | -1.01 | TOE |
| 359 | 525432.74 | 3721470.91 | 2.07 | TBK |

## St. Bernard Parish

**AREA 3**

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**AREA 3 : TYPICAL SECTION AT 1**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 1 | 512944.36 | 3741327.15 | -1.23 | TBK |
| 2 | 512941.85 | 3741320.62 | -2.83 | WE |
| 3 | 512934.68 | 3741301.94 | -7.33 | CB |
| 4 | 512927.51 | 3741283.27 | -8.83 | CB |
| 5 | 512920.35 | 3741264.60 | -7.43 | CB |
| 6 | 512913.18 | 3741245.93 | -10.83 | CB |
| 7 | 512906.01 | 3741227.26 | -4.23 | CB |
| 8 | 512904.22 | 3741222.59 | -2.83 | WE |
| 9 | 512902.07 | 3741216.99 | 0.27 | TBK |

**AREA 3 : TYPICAL SECTION AT 2**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 10 | 510355.94 | 3742632.68 | -1.44 | TBK |
| 11 | 510355.06 | 3742629.81 | -2.84 | WE |
| 12 | 510353.02 | 3742623.12 | -5.34 | CB |
| 13 | 510348.63 | 3742608.77 | -7.34 | CB |
| 14 | 510345.71 | 3742599.21 | -9.84 | CB |
| 15 | 510339.86 | 3742580.08 | -10.94 | CB |
| 16 | 510334.01 | 3742560.96 | -11.84 | CB |
| 17 | 510328.17 | 3742541.83 | -9.44 | CB |
| 18 | 510323.20 | 3742525.57 | -2.84 | WE |
| 19 | 510320.56 | 3742516.97 | -1.54 | SLP |
| 20 | 510318.23 | 3742509.32 | -0.14 | TBK |

**AREA 3 : TYPICAL SECTION AT 3**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 21 | 508070.15 | 3742928.53 | 0.00 | TBK |
| 22 | 508070.31 | 3742922.54 | -1.20 | SLP |
| 23 | 508070.47 | 3742916.54 | -2.90 | WE |
| 24 | 508070.62 | 3742910.54 | -4.90 | CB |
| 25 | 508071.15 | 3742890.55 | -8.90 | CB |
| 26 | 508071.67 | 3742870.55 | -8.90 | CB |
| 27 | 508072.19 | 3742850.56 | -9.20 | CB |
| 28 | 508072.72 | 3742830.57 | -9.90 | CB |
| 29 | 508073.24 | 3742810.57 | -3.90 | CB |
| 30 | 508073.35 | 3742806.58 | -2.90 | WE |
| 31 | 508073.45 | 3742802.58 | -1.60 | SLP |
| 32 | 508073.61 | 3742796.58 | 0.70 | TBK |

**AREA 3 : TYPICAL SECTION AT 5**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 33 | 504933.16 | 3743015.56 | 1.81 | TBK |
| 34 | 504927.90 | 3743012.69 | -0.99 | SLP |
| 35 | 504921.75 | 3743009.33 | -2.69 | WE |
| 36 | 504913.85 | 3743005.02 | -5.69 | CB |
| 37 | 504900.68 | 3742997.84 | -6.09 | CB |
| 38 | 504887.52 | 3742990.65 | -9.29 | CB |
| 39 | 504879.62 | 3742986.34 | -8.39 | CB |
| 40 | 504872.59 | 3742982.51 | -6.69 | CB |
| 41 | 504866.45 | 3742979.16 | -4.99 | CB |
| 42 | 504861.18 | 3742976.29 | -2.69 | WE |
| 43 | 504860.30 | 3742975.81 | -1.39 | SLP |
| 44 | 504852.40 | 3742971.50 | 2.01 | TBK |

**AREA 3 : TYPICAL SECTION AT 6**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 45 | 503875.42 | 3749894.12 | -0.97 | TBK |
| 46 | 503867.46 | 3749893.35 | -2.07 | SLP |
| 47 | 503862.48 | 3749892.87 | -3.07 | WE |
| 48 | 503852.53 | 3749891.92 | -6.07 | CB |
| 49 | 503842.58 | 3749890.96 | -6.37 | CB |
| 50 | 503822.67 | 3749889.04 | -6.27 | CB |
| 51 | 503812.71 | 3749888.08 | -6.17 | CB |
| 52 | 503802.76 | 3749887.12 | -3.07 | WE |
| 53 | 503792.81 | 3749886.17 | -1.77 | SLP |
| 54 | 503782.85 | 3749885.21 | 0.43 | TBK |

**AREA 3 : TYPICAL SECTION AT 7**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 55 | 502968.37 | 3753158.97 | -0.83 | TBK |
| 56 | 502962.19 | 3753155.69 | -1.73 | SLP |
| 57 | 502958.65 | 3753153.81 | -3.03 | WE |
| 58 | 502956.00 | 3753152.40 | -4.03 | CB |
| 59 | 502947.18 | 3753147.70 | -5.03 | CB |
| 60 | 502929.52 | 3753138.32 | -7.53 | CB |
| 61 | 502911.86 | 3753128.93 | -7.63 | CB |
| 69 | 502904.79 | 3753125.17 | -3.03 | WE |
| 70 | 502899.50 | 3753122.35 | -1.93 | TBK |

**AREA 3 : TYPICAL SECTION AT 8**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 62 | 505556.87 | 3760986.53 | -2.97 | WE |
| 63 | 505542.88 | 3760986.16 | -7.17 | CB |
| 64 | 505522.89 | 3760985.64 | -7.67 | CB |
| 65 | 505502.89 | 3760985.12 | -7.07 | CB |
| 66 | 505487.90 | 3760984.72 | -2.97 | WE |
| 67 | 505482.90 | 3760984.59 | -1.47 | TBK |
| 68 | 505562.87 | 3760986.69 | -1.77 | TBK |

**AREA 3 : TYPICAL SECTION AT 9**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 71 | 505060.12 | 3769083.37 | -1.11 | TBK |
| 72 | 505057.25 | 3769082.52 | -3.01 | WE |
| 73 | 505038.07 | 3769076.84 | -7.01 | CB |
| 74 | 505018.89 | 3769071.16 | -9.41 | CB |
| 75 | 504999.72 | 3769065.48 | -9.41 | CB |
| 76 | 504980.54 | 3769059.80 | -10.51 | CB |
| 77 | 504961.36 | 3769054.12 | -4.91 | CB |
| 78 | 504952.73 | 3769051.57 | -3.01 | WE |
| 79 | 504941.23 | 3769048.16 | -1.11 | TBK |

**AREA 3 : TYPICAL SECTION AT 10**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 80 | 503798.82 | 3772539.84 | -2.22 | TBK |
| 81 | 503798.37 | 3772538.95 | -3.02 | WE |
| 82 | 503797.46 | 3772537.17 | -5.02 | CB |
| 83 | 503788.38 | 3772519.35 | -9.52 | CB |
| 84 | 503779.30 | 3772501.53 | -9.22 | CB |
| 85 | 503770.22 | 3772483.71 | -10.22 | CB |
| 86 | 503761.14 | 3772465.88 | -10.12 | CB |
| 87 | 503752.06 | 3772448.06 | -7.52 | CB |
| 88 | 503744.80 | 3772433.81 | -3.02 | WE |
| 89 | 503740.71 | 3772425.79 | -1.32 | TBK |

**AREA 3 : TYPICAL SECTION AT 11**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 90 | 500687.77 | 3773335.93 | 0.59 | TBK |
| 91 | 500689.93 | 3773329.27 | -2.01 | SLP |
| 92 | 500691.47 | 3773324.51 | -3.01 | WE |
| 93 | 500694.26 | 3773315.96 | -3.41 | CB |
| 94 | 500700.44 | 3773296.93 | -4.01 | CB |
| 95 | 500706.62 | 3773277.91 | -3.61 | CB |
| 96 | 500712.80 | 3773258.89 | -3.51 | CB |
| 97 | 500714.65 | 3773253.19 | -4.31 | CB |
| 98 | 500715.89 | 3773249.38 | -6.01 | CB |
| 99 | 500718.98 | 3773239.87 | -9.71 | CB |
| 100 | 500722.99 | 3773227.51 | -3.01 | WE |
| 101 | 500724.23 | 3773223.70 | 1.29 | TBK |
| 285 | 504452.74 | 3761780.48 | -1.50 | TD |
| 286 | 504448.75 | 3761780.31 | -0.30 | SLP |
| 287 | 504443.75 | 3761780.09 | 0.80 | TBK |

**AREA 3 : TYPICAL SECTION AT 12**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 102 | 500290.75 | 3765319.78 | 4.92 | ER |
| 103 | 500287.75 | 3765319.67 | 4.52 | TBK |
| 104 | 500277.76 | 3765319.33 | 0.32 | SLP |
| 105 | 500272.76 | 3765319.15 | -0.68 | WE |
| 106 | 500270.76 | 3765319.08 | -1.28 | BD |
| 107 | 500268.76 | 3765319.01 | -2.48 | BD |
| 108 | 500261.77 | 3765318.77 | -2.68 | BD |
| 109 | 500250.77 | 3765318.38 | -1.98 | BD |
| 110 | 500244.78 | 3765318.17 | -0.68 | WE |

| | | | | |
|---|---|---|---|---|
| 111 | 500238.78 | 3765317.96 | 0.82 | TBK |

**AREA 3 : TYPICAL SECTION AT 13**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 112 | 499544.91 | 3771510.78 | 5.08 | ER |
| 113 | 499544.10 | 3771510.20 | 4.08 | TBK |
| 114 | 499534.39 | 3771503.14 | -1.52 | SLP |
| 115 | 499530.35 | 3771500.20 | -2.72 | WE |
| 116 | 499526.30 | 3771497.26 | -3.72 | DB |
| 117 | 499519.02 | 3771491.97 | -4.32 | DB |
| 118 | 499512.55 | 3771487.27 | -3.72 | DB |
| 119 | 499509.31 | 3771484.92 | -2.72 | WE |
| 120 | 499504.46 | 3771481.39 | -1.42 | SLP |
| 121 | 499498.80 | 3771477.28 | 0.58 | SLP |
| 122 | 499490.70 | 3771471.40 | 2.28 | TBK |

**AREA 3 : TYPICAL SECTION AT 14**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 123 | 499472.26 | 3772962.60 | 1.66 | TBK |
| 124 | 499474.41 | 3772956.99 | -0.94 | SLP |
| 125 | 499477.63 | 3772948.59 | -2.94 | WE |
| 126 | 499479.78 | 3772942.99 | -4.34 | CB |
| 127 | 499483.37 | 3772933.65 | -4.94 | CB |
| 128 | 499486.95 | 3772924.32 | -5.74 | CB |
| 129 | 499494.12 | 3772905.65 | -4.24 | CB |
| 130 | 499494.83 | 3772903.78 | -2.94 | WE |
| 131 | 499497.34 | 3772897.24 | -1.24 | SLP |
| 132 | 499498.78 | 3772893.51 | 1.66 | TBK |

**AREA 3 : TYPICAL SECTION AT 15**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 102 | 500290.75 | 3765319.78 | 4.92 | ER |
| 103 | 500287.75 | 3765319.67 | 4.52 | TBK |
| 133 | 498364.26 | 3772544.24 | 1.89 | TBK |
| 134 | 498365.29 | 3772540.38 | -0.71 | SLP |
| 135 | 498367.62 | 3772531.69 | -2.91 | WE |
| 136 | 498370.73 | 3772520.10 | -6.11 | CB |
| 137 | 498373.32 | 3772510.44 | -6.71 | CB |
| 138 | 498375.91 | 3772500.78 | -7.31 | CB |
| 139 | 498378.49 | 3772491.12 | -7.01 | CB |
| 140 | 498381.08 | 3772481.46 | -6.61 | CB |
| 141 | 498384.71 | 3772467.94 | -2.91 | WE |
| 142 | 498387.04 | 3772459.24 | -0.91 | SLP |
| 143 | 498388.59 | 3772453.45 | 1.19 | TBK |

**AREA 3 : TYPICAL SECTION AT 16**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 366 | 495995.62 | 3768430.89 | 0.83 | TBK |
| 367 | 496001.60 | 3768431.36 | -1.87 | SLP |
| 368 | 496006.59 | 3768431.75 | -2.97 | WE |
| 369 | 496008.58 | 3768431.90 | -4.67 | CB |
| 370 | 496018.55 | 3768432.68 | -5.47 | CB |
| 371 | 496038.49 | 3768434.24 | -7.57 | CB |
| 372 | 496058.43 | 3768435.80 | -6.97 | CB |

| | | | | |
|---|---|---|---|---|
| 373 | 496074.38 | 3768437.04 | -2.97 | WE |
| 374 | 496081.36 | 3768437.59 | -1.07 | SLP |
| 375 | 496087.34 | 3768438.06 | 0.73 | TBK |
| 375 | 496087.34 | 3768438.06 | 0.73 | TBK |

**AREA 3 : TYPICAL SECTION AT 17**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 144 | 495767.85 | 3751050.87 | -2.08 | TBK |
| 145 | 495771.84 | 3751050.72 | -2.98 | WE |
| 146 | 495791.83 | 3751050.00 | -6.48 | CB |
| 147 | 495811.82 | 3751049.27 | -8.08 | CB |
| 148 | 495831.80 | 3751048.54 | -8.98 | CB |
| 149 | 495851.79 | 3751047.82 | -9.28 | CB |
| 150 | 495866.78 | 3751047.27 | -7.58 | CB |
| 151 | 495876.77 | 3751046.91 | -2.98 | WE |
| 152 | 495881.77 | 3751046.73 | -1.28 | TBK |

**AREA 3 : TYPICAL SECTION AT 18**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 153 | 500879.97 | 3757034.41 | 5.58 | ER |
| 154 | 500877.07 | 3757033.63 | 5.18 | TBK |
| 155 | 500871.28 | 3757032.08 | 3.08 | SLP |
| 156 | 500865.48 | 3757030.53 | 0.08 | WE |
| 157 | 500862.58 | 3757029.75 | -1.02 | DB |
| 158 | 500857.75 | 3757028.46 | -1.52 | DB |
| 159 | 500852.92 | 3757027.16 | -1.92 | DB |
| 160 | 500844.23 | 3757024.83 | -1.42 | DB |
| 161 | 500836.50 | 3757022.76 | 0.08 | WE |
| 162 | 500828.78 | 3757020.69 | 3.38 | TBK |

**AREA 3 : TYPICAL SECTION AT 19**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 163 | 500040.31 | 3750236.45 | 7.94 | ER |
| 164 | 500033.47 | 3750234.94 | 4.84 | SLP |
| 165 | 500025.66 | 3750233.21 | 1.04 | WE |
| 166 | 500015.90 | 3750231.04 | -0.16 | TD |
| 167 | 500008.09 | 3750229.31 | 0.34 | TD |
| 168 | 500006.14 | 3750228.88 | 1.04 | WE |
| 169 | 499999.30 | 3750227.36 | 3.34 | TBK |

**AREA 3 : TYPICAL SECTION AT 20**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 170 | 500347.36 | 3743685.66 | 8.12 | ER |
| 171 | 500344.37 | 3743685.51 | 7.82 | TBK |
| 172 | 500340.37 | 3743685.30 | 7.02 | SLP |
| 173 | 500331.38 | 3743684.82 | 2.72 | WE |
| 174 | 500324.39 | 3743684.46 | 1.72 | TD |
| 175 | 500312.41 | 3743683.83 | 1.72 | TD |
| 176 | 500306.42 | 3743683.52 | 2.72 | WE |
| 177 | 500299.43 | 3743683.15 | 5.52 | TBK |

**AREA 3 : TYPICAL SECTION AT 21**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 178 | 495553.89 | 3735396.14 | 0.67 | TBK |
| 179 | 495564.89 | 3735396.33 | -1.53 | SLP |
| 180 | 495568.89 | 3735396.40 | -2.93 | WE |
| 181 | 495587.88 | 3735396.74 | -5.93 | CB |
| 182 | 495607.88 | 3735397.08 | -7.03 | CB |
| 183 | 495627.88 | 3735397.43 | -9.43 | CB |
| 184 | 495647.88 | 3735397.78 | -7.03 | CB |
| 185 | 495665.87 | 3735398.10 | -2.93 | WE |
| 186 | 495669.87 | 3735398.17 | -1.43 | SLP |
| 187 | 495681.87 | 3735398.38 | 1.07 | TBK |

**AREA 3 : TYPICAL SECTION AT 22**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 188 | 500336.18 | 3738765.29 | 8.64 | ER |
| 189 | 500331.18 | 3738765.51 | 8.14 | TBK |
| 190 | 500328.19 | 3738765.64 | 7.14 | SLP |
| 191 | 500320.19 | 3738765.99 | 3.34 | WE |
| 192 | 500314.20 | 3738766.25 | 1.54 | TD |
| 193 | 500306.21 | 3738766.60 | 1.54 | TD |
| 194 | 500299.21 | 3738766.90 | 3.34 | WE |
| 195 | 500292.22 | 3738767.21 | 6.64 | TBK |

**AREA 3 : TYPICAL SECTION AT 23**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 196 | 502437.51 | 3737069.24 | 4.29 | TBK |
| 197 | 502428.64 | 3737067.67 | -1.11 | WE |
| 198 | 502423.72 | 3737066.81 | -2.01 | CLD |
| 199 | 502419.78 | 3737066.11 | -1.11 | WE |
| 200 | 502409.93 | 3737064.38 | 5.39 | TBK |

**AREA 3 : TYPICAL SECTION AT 24**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 201 | 501895.01 | 3741813.45 | 2.45 | TBK |
| 202 | 501899.00 | 3741813.73 | -0.25 | SLP |
| 203 | 501903.99 | 3741814.08 | -1.85 | SLP |
| 204 | 501904.99 | 3741814.14 | -2.85 | WE |
| 205 | 501907.98 | 3741814.35 | -3.85 | DB |
| 206 | 501912.97 | 3741814.70 | -4.85 | DB |
| 207 | 501918.95 | 3741815.12 | -5.35 | DB |
| 208 | 501927.93 | 3741815.75 | -5.45 | DB |
| 209 | 501931.92 | 3741816.03 | -2.85 | WE |
| 210 | 501934.91 | 3741816.24 | -1.55 | SLP |
| 211 | 501941.90 | 3741816.73 | 1.65 | TBK |

**AREA 3 : TYPICAL SECTION AT 25**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 212 | 501913.29 | 3742411.54 | 0.67 | TBK |
| 213 | 501913.55 | 3742408.55 | -0.14 | SLP |
| 214 | 501914.25 | 3742400.58 | -2.73 | WE |
| 215 | 501914.60 | 3742396.60 | -4.24 | DB |
| 216 | 501915.73 | 3742383.65 | -7.24 | DB |
| 217 | 501916.78 | 3742371.69 | -5.13 | DB |

| | | | | |
|---|---|---|---|---|
| 218 | 501917.21 | 3742366.71 | -2.73 | WE |
| 219 | 501917.30 | 3742365.72 | -1.74 | SLP |
| 220 | 501917.56 | 3742362.73 | -0.94 | SLP |
| 221 | 501918.09 | 3742356.75 | 0.96 | TBK |

**AREA 3 : TYPICAL SECTION AT 26**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 222 | 503002.82 | 3744659.86 | 5.47 | ER |
| 223 | 503003.65 | 3744640.87 | 3.07 | SLP |
| 224 | 503004.17 | 3744628.89 | 1.37 | NG |
| 225 | 503004.39 | 3744623.89 | 0.47 | WE |
| 226 | 503004.65 | 3744617.90 | -0.23 | CLD |
| 227 | 503004.83 | 3744613.90 | 0.47 | WE |
| 228 | 503005.00 | 3744609.90 | 1.87 | SLP |
| 229 | 503005.44 | 3744599.91 | 3.57 | TBK |

**AREA 3 : TYPICAL SECTION AT 27**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 230 | 502158.16 | 3746505.30 | 6.07 | ER |
| 231 | 502154.16 | 3746505.23 | 5.47 | SLP |
| 232 | 502136.16 | 3746504.92 | 3.27 | SLP |
| 233 | 502113.16 | 3746504.52 | 1.07 | TBK |
| 234 | 502104.16 | 3746504.36 | -0.43 | WE |
| 235 | 502098.17 | 3746504.25 | -1.73 | CLD |
| 236 | 502094.17 | 3746504.18 | -0.43 | WE |
| 237 | 502089.17 | 3746504.10 | 1.17 | TBK |

**AREA 3 : TYPICAL SECTION AT 28**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 238 | 502196.13 | 3749425.63 | 6.06 | ER |
| 239 | 502190.13 | 3749425.73 | 5.56 | SLP |
| 240 | 502174.13 | 3749426.01 | 3.46 | SLP |
| 241 | 502160.14 | 3749426.26 | 1.16 | SLP |
| 242 | 502151.14 | 3749426.41 | 0.16 | TBK |
| 243 | 502148.14 | 3749426.46 | -0.24 | WE |
| 244 | 502143.14 | 3749426.55 | -1.54 | CLD |
| 245 | 502137.14 | 3749426.66 | -0.24 | WE |
| 246 | 502133.14 | 3749426.73 | 1.26 | TBK |

**AREA 3 : TYPICAL SECTION AT 29**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 247 | 502255.47 | 3751666.31 | 5.70 | ER |
| 248 | 502251.47 | 3751666.31 | 5.20 | SLP |
| 249 | 502245.47 | 3751666.31 | 4.30 | SLP |
| 250 | 502235.47 | 3751666.31 | 3.50 | SLP |
| 251 | 502217.47 | 3751666.31 | 1.50 | SLP |
| 252 | 502197.47 | 3751666.31 | 0.20 | TBK |
| 253 | 502187.47 | 3751666.31 | -1.40 | WE |
| 254 | 502184.47 | 3751666.31 | -2.80 | CLD |
| 255 | 502176.47 | 3751666.31 | -1.40 | WE |
| 256 | 502171.47 | 3751666.31 | 0.20 | TBK |

**AREA 3 : TYPICAL SECTION AT 30**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 257 | 502355.33 | 3754355.53 | 6.83 | ER |
| 258 | 502350.38 | 3754356.23 | 6.23 | SLP |
| 259 | 502339.49 | 3754357.76 | 3.83 | SLP |
| 260 | 502323.64 | 3754359.98 | 1.53 | SLP |
| 261 | 502301.86 | 3754363.05 | -0.17 | WE |
| 262 | 502297.90 | 3754363.60 | -2.17 | TD |
| 263 | 502290.96 | 3754364.58 | -2.17 | TD |
| 264 | 502283.04 | 3754365.69 | 0.13 | TBK |

**AREA 3 : TYPICAL SECTION AT 31**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 265 | 503107.92 | 3756773.71 | 5.91 | ER |
| 266 | 503089.12 | 3756780.55 | 3.61 | SLP |
| 267 | 503055.29 | 3756792.86 | 0.31 | TBK |
| 268 | 503050.59 | 3756794.57 | -3.39 | TD |
| 269 | 503044.02 | 3756796.97 | -3.19 | TD |
| 270 | 503038.38 | 3756799.02 | 0.31 | TBK |

**AREA 3 : TYPICAL SECTION AT 32**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 271 | 504045.95 | 3759161.84 | 5.95 | ER |
| 272 | 504026.03 | 3759168.50 | 3.85 | SLP |
| 273 | 504007.07 | 3759174.85 | 0.85 | SLP |
| 274 | 503993.79 | 3759179.29 | -0.15 | TBK |
| 275 | 503990.00 | 3759180.56 | -2.15 | TD |
| 276 | 503983.36 | 3759182.78 | -4.15 | CLD |
| 277 | 503979.56 | 3759184.05 | -1.55 | TD |
| 278 | 503974.82 | 3759185.64 | 0.85 | TBK |

**AREA 3 : TYPICAL SECTION AT 33**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 279 | 504519.68 | 3761783.40 | 5.70 | ER |
| 280 | 504494.70 | 3761782.31 | 3.10 | SLP |
| 281 | 504477.72 | 3761781.57 | 0.70 | SLP |
| 282 | 504466.73 | 3761781.09 | 0.10 | TBK |
| 283 | 504461.74 | 3761780.87 | -1.30 | TD |
| 284 | 504458.74 | 3761780.74 | -1.50 | CLD |
| 285 | 504452.74 | 3761780.48 | -1.50 | TD |
| 286 | 504448.75 | 3761780.31 | -0.30 | SLP |
| 287 | 504443.75 | 3761780.09 | 0.80 | TBK |

**AREA 3 : TYPICAL SECTION AT 34**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 288 | 504330.64 | 3764320.72 | 4.94 | ER |
| 289 | 504303.97 | 3764316.49 | 4.34 | SLP |
| 290 | 504289.16 | 3764314.15 | 3.74 | SLP |
| 291 | 504275.33 | 3764311.96 | 0.04 | TBK |
| 292 | 504268.41 | 3764310.86 | -2.56 | TD |
| 293 | 504264.46 | 3764310.24 | -2.96 | CLD |
| 294 | 504257.55 | 3764309.14 | -2.66 | TD |
| 295 | 504252.61 | 3764308.36 | -1.56 | SLP |
| 296 | 504248.66 | 3764307.73 | 0.24 | TBK |

**AREA 3 : TYPICAL SECTION AT 35**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 297 | 504135.62 | 3766917.68 | 4.27 | ER |
| 298 | 504113.68 | 3766916.15 | 1.57 | SLP |
| 299 | 504092.73 | 3766914.68 | -0.23 | SLP |
| 300 | 504074.77 | 3766913.43 | -1.53 | TBK |
| 301 | 504069.78 | 3766913.08 | -3.33 | TD |
| 302 | 504062.80 | 3766912.59 | -4.13 | CLD |
| 303 | 504056.81 | 3766912.17 | -3.23 | TD |
| 304 | 504052.82 | 3766911.89 | -1.13 | TBK |

**AREA 3 : TYPICAL SECTION AT 36**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 305 | 503921.94 | 3769559.05 | 3.12 | ER |
| 306 | 503896.51 | 3769553.64 | 1.92 | SLP |
| 307 | 503869.12 | 3769547.82 | -0.78 | TBK |
| 308 | 503859.34 | 3769545.74 | -3.98 | TD |
| 309 | 503851.52 | 3769544.08 | -7.98 | CLD |
| 310 | 503843.69 | 3769542.42 | -7.88 | TD |
| 311 | 503837.82 | 3769541.17 | -0.68 | TBK |

**AREA 3 : TYPICAL SECTION AT 37**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 312 | 502504.94 | 3771565.22 | 4.01 | ER |
| 313 | 502495.54 | 3771552.28 | 2.81 | SLP |
| 314 | 502483.19 | 3771535.29 | 1.01 | SLP |
| 315 | 502472.03 | 3771519.92 | -0.19 | TBK |
| 316 | 502468.50 | 3771515.06 | -1.39 | SLP |
| 317 | 502466.15 | 3771511.82 | -2.89 | WE |
| 318 | 502463.80 | 3771508.59 | -3.99 | DB |
| 319 | 502462.03 | 3771506.16 | -6.59 | DB |
| 320 | 502457.33 | 3771499.69 | -5.69 | DB |
| 321 | 502454.39 | 3771495.64 | -2.89 | WE |
| 322 | 502452.63 | 3771493.22 | -1.39 | TBK |

**AREA 3 : TYPICAL SECTION AT 38**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 323 | 500373.84 | 3773163.32 | 8.16 | ER |
| 324 | 500368.34 | 3773153.80 | 6.86 | SLP |
| 325 | 500352.34 | 3773126.08 | 0.96 | SLP |
| 326 | 500338.84 | 3773102.70 | -1.74 | TBK |
| 327 | 500338.34 | 3773101.83 | -2.64 | WE |
| 328 | 500336.84 | 3773099.24 | -3.14 | DB |
| 329 | 500335.84 | 3773097.50 | -7.54 | DB |
| 330 | 500333.84 | 3773094.04 | -9.54 | DB |
| 331 | 500331.34 | 3773089.71 | -5.44 | DB |
| 332 | 500329.84 | 3773087.11 | -2.64 | WE |
| 333 | 500328.84 | 3773085.38 | -1.44 | TBK |

**AREA 3 : TYPICAL SECTION AT 39**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 95 | 500706.62 | 3773277.91 | -3.61 | CB |
| 127 | 499483.37 | 3772933.65 | -4.94 | CB |
| 128 | 499486.95 | 3772924.32 | -5.74 | CB |
| 323 | 500373.84 | 3773163.32 | 8.16 | ER |
| 334 | 500283.95 | 3773150.57 | -3.01 | WE |
| 335 | 500290.67 | 3773152.53 | -0.81 | TBK |
| 336 | 500304.12 | 3773156.43 | 0.39 | SLP |
| 337 | 500324.28 | 3773162.28 | 3.49 | SLP |
| 338 | 500348.29 | 3773169.25 | 7.19 | SLP |
| 339 | 500360.78 | 3773172.87 | 8.19 | ER |
| 340 | 500404.95 | 3773185.69 | 8.39 | ER |
| 341 | 500425.12 | 3773191.55 | 6.79 | NG |
| 342 | 500449.13 | 3773198.52 | 8.39 | ER |
| 343 | 500496.19 | 3773212.17 | 7.59 | ER |
| 344 | 500522.12 | 3773219.70 | 4.74 | SLP |
| 345 | 500541.33 | 3773225.27 | 1.44 | TBK |
| 346 | 500548.05 | 3773227.22 | -2.76 | WE |

**AREA 3 : TYPICAL SECTION AT 40**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 90 | 500687.77 | 3773335.93 | 0.59 | TBK |
| 91 | 500689.93 | 3773329.27 | -2.01 | SLP |
| 334 | 500283.95 | 3773150.57 | -3.01 | WE |
| 335 | 500290.67 | 3773152.53 | -0.81 | TBK |
| 336 | 500304.12 | 3773156.43 | 0.39 | SLP |
| 337 | 500324.28 | 3773162.28 | 3.49 | SLP |
| 338 | 500348.29 | 3773169.25 | 7.19 | SLP |
| 339 | 500360.78 | 3773172.87 | 8.19 | ER |
| 340 | 500404.95 | 3773185.69 | 8.39 | ER |
| 347 | 498970.07 | 3772502.25 | 3.86 | ER |
| 348 | 498969.17 | 3772501.81 | 3.26 | TBK |
| 349 | 498964.68 | 3772499.62 | 1.86 | SLP |
| 350 | 498961.09 | 3772497.87 | -0.24 | SLP |
| 351 | 498958.39 | 3772496.55 | -0.84 | SLP |
| 352 | 498953.89 | 3772494.36 | -2.84 | WE |
| 353 | 498950.30 | 3772492.61 | -4.24 | DB |
| 354 | 498939.51 | 3772487.35 | -6.14 | DB |
| 355 | 498934.12 | 3772484.72 | -3.84 | DB |
| 356 | 498928.73 | 3772482.09 | -2.84 | WE |
| 357 | 498926.03 | 3772480.77 | -1.84 | SLP |
| 358 | 498922.44 | 3772479.02 | 0.56 | TBK |

**AREA 3 : TYPICAL SECTION AT 41**

| Point Number | Northing | Easting | Elevation (ft) | Description |
|---|---|---|---|---|
| 1 | 512944.36 | 3741327.15 | -1.23 | TBK |
| 2 | 512941.85 | 3741320.62 | -2.83 | WE |
| 352 | 498953.89 | 3772494.36 | -2.84 | WE |
| 353 | 498950.30 | 3772492.61 | -4.24 | DB |
| 354 | 498939.51 | 3772487.35 | -6.14 | DB |
| 355 | 498934.12 | 3772484.72 | -3.84 | DB |
| 356 | 498928.73 | 3772482.09 | -2.84 | WE |
| 359 | 498929.38 | 3772515.59 | -2.87 | WE |
| 360 | 498927.33 | 3772520.15 | -0.97 | SLP |
| 361 | 498923.64 | 3772528.36 | 0.83 | TBK |
| 362 | 498921.18 | 3772533.83 | 1.23 | RMP |
| 363 | 498911.33 | 3772555.72 | 1.53 | RMP |
| 364 | 498907.64 | 3772563.93 | 1.53 | TBK |
| 365 | 498905.59 | 3772568.49 | -2.87 | WE |

# Appendix 4
# IHNC West Bank Breach Surveys

## Florida Ave. to I-10, on and along France Road

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**Refer to digital file "IHNCFRANCERD.dc" for raw data.**

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| OP17 | 542897.98 | 3688637.67 | -2.15 | RTK BASE |
| TBM FRANCE | 543277.00 | 3694356.18 | 4.62 | CHK |
| IHNC2 | 549241.35 | 3694222.18 | 11.94 | HUB AND TACK |
| IHNC1 | 548991.46 | 3693868.93 | 4.35 | SPIKE NAIL |
| 100 | 549420.94 | 3694236.63 | 12.41 | TOP CONC FLDWALL |
| 101 | 549418.78 | 3694236.47 | 4.24 | TOE FLDGATE |
| 102 | 549387.88 | 3694245.77 | 4.66 | TOE FLDGATE |
| 103 | 549385.80 | 3694246.87 | 12.46 | TOP CONC FLDWALL |
| 104 | 549376.64 | 3694249.92 | 12.42 | TOP CONC FLDWALL |
| 105 | 549376.41 | 3694249.95 | 13.20 | TOP CONC FLDWALL |
| 106 | 549375.55 | 3694250.66 | 13.19 | TOP CONC FLDWALL |
| 107 | 549344.99 | 3694259.83 | 12.92 | TOP CONC FLDWALL |
| 108 | 549325.45 | 3694265.08 | 12.73 | END FLDWALL |
| 109 | 549324.79 | 3694265.36 | 12.73 | C\L LEVEE |
| 110 | 549315.94 | 3694266.33 | 12.96 | EDGE RAMP |
| 111 | 549299.26 | 3694266.27 | 11.73 | C\L RAMP |
| 112 | 549283.85 | 3694260.65 | 11.74 | EDGE RAMP |
| 113 | 549262.73 | 3694245.80 | 12.02 | C\L LEVEE |
| 114 | 549193.32 | 3694168.87 | 12.43 | C\L LEVEE |
| 115 | 549152.95 | 3694118.09 | 12.25 | C\L LEVEE |
| 116 | 549127.74 | 3694081.39 | 12.16 | C\L LEVEE |
| 117 | 549095.07 | 3694026.87 | 12.12 | C\L LEVEE |
| 118 | 549064.34 | 3693973.45 | 11.91 | C\L LEVEE |
| 119 | 549064.01 | 3693972.61 | 11.87 | EDGE CONC FLDWALL |
| 120 | 549062.41 | 3693966.58 | 12.01 | TOP CONC FLDWALL |
| 121 | 548995.18 | 3693940.36 | 12.08 | TOP CONC FLDWALL |
| 122 | 548942.26 | 3693918.99 | 12.62 | TOP CONC FLDWALL |
| 123 | 548899.59 | 3693923.05 | 12.84 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| 124 | 548856.89 | 3693926.79 | 13.01 | TOP CONC FLDWALL |
| 125 | 548856.41 | 3693926.69 | 12.50 | TOP CONC FLDWALL |
| 126 | 548843.65 | 3693927.51 | 12.51 | TOP CONC FLDWALL |
| 127 | 548843.15 | 3693925.12 | 12.54 | TOP CONC FLDWALL |
| 128 | 548841.09 | 3693907.95 | 12.50 | TOP CONC FLDWALL |
| 129 | 548841.19 | 3693905.65 | 3.16 | TOE FLDGATE |
| 130 | 548839.44 | 3693888.98 | 3.29 | TOE FLDGATE |
| 131 | 548838.68 | 3693886.79 | 12.50 | TOP CONC FLDWALL |
| 132 | 548837.34 | 3693876.98 | 12.51 | TOP CONC FLDWALL |
| 133 | 548835.44 | 3693876.86 | 12.51 | TOP CONC FLDWALL |
| 134 | 548834.17 | 3693865.73 | 12.46 | TOP CONC FLDWALL |
| 135 | 548773.68 | 3693870.59 | 12.42 | TOP CONC FLDWALL |
| 136 | 548771.92 | 3693856.48 | 12.38 | END CONC FLDWALL |
| 137 | 548771.93 | 3693855.78 | 12.00 | TOE |
| 138 | 548771.65 | 3693853.37 | 12.26 | EDGE ASPHALT ROAD |
| 139 | 548769.60 | 3693842.84 | 12.23 | C\L ROAD |
| 140 | 548768.77 | 3693829.19 | 12.04 | EDGE ASPHALT ROAD |
| 141 | 548767.29 | 3693819.40 | 11.91 | NG |
| 142 | 548767.87 | 3693803.73 | 12.65 | EDGE ASPHALT ROAD |
| 143 | 548767.49 | 3693792.66 | 12.59 | C\L ROAD |
| 144 | 548766.92 | 3693779.38 | 12.39 | EDGE ASPHALT ROAD |
| 145 | 548766.47 | 3693776.99 | 12.51 | C\L LEVEE |
| 146 | 548766.09 | 3693772.09 | 12.78 | C\L LEVEE |
| 147 | 548764.43 | 3693759.25 | 12.00 | C\L LEVEE |
| 148 | 548762.26 | 3693740.50 | 12.24 | C\L LEVEE |
| 149 | 548754.71 | 3693662.48 | 12.00 | C\L LEVEE |
| 150 | 548746.64 | 3693587.22 | 12.25 | C\L LEVEE |
| 151 | 548744.77 | 3693586.82 | 12.25 | END CONC FLDWALL |
| 152 | 548741.80 | 3693558.00 | 12.81 | TOP CONC FLDWALL |
| 153 | 548718.17 | 3693557.01 | 12.96 | TOP CONC FLDWALL |
| 154 | 548655.30 | 3693562.95 | 13.20 | TOP CONC FLDWALL |
| 155 | 548618.19 | 3693566.60 | 13.03 | TOP CONC FLDWALL |
| 156 | 548537.14 | 3693574.46 | 12.99 | TOP CONC FLDWALL |
| 157 | 548446.64 | 3693582.90 | 12.98 | TOP CONC FLDWALL |
| 158 | 548356.58 | 3693591.72 | 12.91 | TOP CONC FLDWALL |
| 159 | 548266.88 | 3693600.17 | 12.85 | TOP CONC FLDWALL |
| 160 | 548178.01 | 3693608.68 | 12.89 | TOP CONC FLDWALL |
| 161 | 548085.89 | 3693617.45 | 12.95 | TOP CONC FLDWALL |
| 162 | 547996.98 | 3693625.66 | 13.18 | TOP CONC FLDWALL |
| 163 | 547907.34 | 3693634.09 | 13.21 | TOP CONC FLDWALL |
| 164 | 547818.48 | 3693642.77 | 13.19 | TOP CONC FLDWALL |
| 165 | 547729.40 | 3693651.49 | 13.12 | TOP CONC FLDWALL |
| 166 | 547639.73 | 3693659.76 | 13.11 | TOP CONC FLDWALL |
| 167 | 547549.87 | 3693668.43 | 13.18 | TOP CONC FLDWALL |
| 168 | 547490.78 | 3693673.89 | 13.21 | TOP CONC FLDWALL |
| 169 | 547401.64 | 3693682.34 | 13.30 | TOP CONC FLDWALL |
| 170 | 547311.77 | 3693690.94 | 13.34 | TOP CONC FLDWALL |
| 171 | 547222.97 | 3693699.60 | 13.27 | TOP CONC FLDWALL |
| 172 | 547133.51 | 3693708.24 | 13.26 | TOP CONC FLDWALL |
| 173 | 547044.38 | 3693716.38 | 13.30 | TOP CONC FLDWALL |
| 174 | 546954.80 | 3693724.96 | 13.36 | TOP CONC FLDWALL |
| 175 | 546833.37 | 3693736.62 | 13.21 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| 176 | 546743.74 | 3693745.16 | 13.18 | TOP CONC FLDWALL |
| 177 | 546713.97 | 3693747.80 | 13.22 | TOP CONC FLDWALL |
| 178 | 546683.70 | 3693749.77 | 13.23 | TOP CONC FLDWALL |
| 179 | 546608.19 | 3693755.43 | 13.33 | TOP CONC FLDWALL |
| 180 | 546535.25 | 3693771.23 | 13.36 | TOP CONC FLDWALL |
| 181 | 546447.37 | 3693790.41 | 13.26 | TOP CONC FLDWALL |
| 182 | 546330.00 | 3693816.67 | 13.22 | TOP CONC FLDWALL |
| 183 | 546242.06 | 3693836.14 | 13.19 | TOP CONC FLDWALL |
| 184 | 546153.50 | 3693855.83 | 13.25 | TOP CONC FLDWALL |
| 185 | 546064.06 | 3693875.42 | 13.19 | TOP CONC FLDWALL |
| 186 | 545974.27 | 3693895.22 | 13.23 | TOP CONC FLDWALL |
| 187 | 545885.62 | 3693914.78 | 13.23 | TOP CONC FLDWALL |
| 188 | 545795.58 | 3693935.09 | 13.10 | TOP CONC FLDWALL |
| 189 | 545706.97 | 3693954.65 | 13.16 | TOP CONC FLDWALL |
| 190 | 545677.54 | 3693961.10 | 13.14 | TOP CONC FLDWALL |
| 191 | 545648.30 | 3693967.82 | 13.25 | TOP CONC FLDWALL |
| 192 | 545560.00 | 3693987.19 | 13.03 | TOP CONC FLDWALL |
| 193 | 545471.87 | 3694006.25 | 12.98 | TOP CONC FLDWALL |
| 194 | 545384.37 | 3694025.94 | 13.07 | TOP CONC FLDWALL |
| 195 | 545295.95 | 3694045.87 | 12.88 | TOP CONC FLDWALL |
| 196 | 545209.89 | 3694064.79 | 12.82 | TOP CONC FLDWALL |
| 197 | 545119.41 | 3694084.75 | 12.69 | TOP CONC FLDWALL |
| 198 | 545030.89 | 3694104.21 | 12.74 | TOP CONC FLDWALL |
| 199 | 544971.73 | 3694117.35 | 12.90 | TOP CONC FLDWALL |
| 200 | 544884.27 | 3694136.82 | 12.92 | TOP CONC FLDWALL |
| 201 | 544796.24 | 3694156.45 | 12.81 | TOP CONC FLDWALL |
| 202 | 544708.79 | 3694175.70 | 12.86 | TOP CONC FLDWALL |
| 203 | 544620.41 | 3694195.26 | 13.03 | TOP CONC FLDWALL |
| 204 | 544532.58 | 3694214.70 | 12.99 | TOP CONC FLDWALL |
| 205 | 544444.85 | 3694233.95 | 13.19 | TOP CONC FLDWALL |
| 206 | 544357.14 | 3694253.37 | 13.08 | TOP CONC FLDWALL |
| 207 | 544269.64 | 3694272.88 | 13.11 | TOP CONC FLDWALL |
| 208 | 544181.20 | 3694292.16 | 12.97 | TOP CONC FLDWALL |
| 209 | 544123.61 | 3694304.53 | 12.79 | END CONC FLDWALL |
| 210 | 544122.32 | 3694304.55 | 4.52 | TOE-END FLDWALL |
| 211 | 544178.20 | 3694335.09 | 1.62 | NG |
| 212 | 544172.88 | 3694325.08 | 1.56 | TOE |
| 213 | 544166.25 | 3694309.68 | 2.96 | SLOPE |
| 214 | 544162.69 | 3694296.55 | 6.20 | TOE |
| 215 | 544162.39 | 3694296.51 | 12.89 | TOP CONC FLDWALL |
| 216 | 544156.66 | 3694295.47 | 4.01 | TOE |
| 217 | 544154.57 | 3694280.06 | 3.86 | TOP |
| 218 | 544152.67 | 3694271.80 | 2.10 | TOE |
| 219 | 544152.00 | 3694267.26 | 2.69 | TOP OF RAIL |
| 220 | 544150.60 | 3694262.75 | 2.55 | TOP OF RAIL |
| 221 | 544150.96 | 3694259.15 | 1.83 | TOP |
| 222 | 544149.29 | 3694253.17 | 0.71 | TOE |
| 223 | 544040.90 | 3694157.17 | 0.18 | NG |
| 224 | 544036.29 | 3694197.99 | 0.34 | NG |
| 225 | 543996.63 | 3694102.68 | -0.27 | NG |
| 226 | 543944.83 | 3694115.82 | -0.48 | NG |
| 227 | 543966.04 | 3694195.08 | 0.37 | NG |

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| 228 | 543972.84 | 3694229.28 | 0.26 | NG |
| 229 | 543865.48 | 3694266.47 | -0.30 | NG |
| 230 | 543842.28 | 3694195.00 | -0.30 | NG |
| 231 | 543714.06 | 3694229.75 | -1.11 | NG |
| 232 | 543714.77 | 3694272.91 | -1.02 | NG |
| 233 | 543718.92 | 3694302.91 | -1.10 | NG |
| 234 | 543579.42 | 3694344.35 | -1.06 | NG |
| 235 | 543567.48 | 3694299.93 | -1.00 | NG |
| 236 | 543555.44 | 3694252.79 | -1.05 | NG |
| 237 | 543666.19 | 3694276.54 | -1.11 | NG |
| 238 | 543656.27 | 3694249.26 | -0.98 | NG |
| 239 | 543642.45 | 3694217.94 | -1.12 | NG |
| 240 | 543467.10 | 3694367.13 | -0.30 | NG |
| 241 | 543451.95 | 3694332.13 | -0.31 | NG |
| 242 | 543440.39 | 3694292.41 | -0.17 | NG |
| 243 | 544137.48 | 3694302.31 | 8.29 | C\L LEVEE |
| 244 | 544136.27 | 3694313.20 | 8.05 | C\L LEVEE |
| 245 | 544129.87 | 3694320.69 | 8.00 | C\L LEVEE |
| 246 | 544031.41 | 3694342.20 | 7.94 | C\L LEVEE |
| 247 | 543935.15 | 3694363.94 | 7.98 | C\L LEVEE |
| 248 | 543837.45 | 3694386.52 | 7.95 | C\L LEVEE |
| 249 | 543803.94 | 3694398.08 | 7.85 | C\L LEVEE |
| 250 | 543730.69 | 3694414.59 | 7.71 | C\L LEVEE |
| 251 | 543632.90 | 3694433.45 | 7.60 | C\L LEVEE |
| 252 | 543534.10 | 3694449.87 | 7.94 | C\L LEVEE |
| 253 | 543435.57 | 3694465.09 | 7.87 | C\L LEVEE |
| 254 | 543390.76 | 3694471.25 | 7.79 | C\L LEVEE |
| 255 | 543378.55 | 3694470.39 | 7.76 | C\L LEVEE |
| 256 | 543308.05 | 3694452.53 | 7.82 | C\L LEVEE |
| 257 | 543309.42 | 3694446.68 | 7.64 | C\L LEVEE-END |
| 258 | 543312.25 | 3694446.31 | 3.68 | TOE-END FLOODWALL |
| 259 | 543311.32 | 3694446.79 | 13.35 | END CONC FLDWALL |
| IHNC3 | 543247.21 | 3694283.72 | 0.88 | 1\2IN REBAR |
| IHNC4 | 543325.35 | 3694176.11 | 1.00 | 1\2IN REBAR |
| 260 | 543112.38 | 3694397.80 | 7.78 | C\L LEVEE-END |
| 261 | 543108.44 | 3694401.69 | 8.13 | C\L LEVEE |
| 262 | 543014.07 | 3694377.52 | 7.70 | C\L LEVEE |
| 263 | 542917.45 | 3694354.47 | 8.11 | C\L LEVEE |
| 264 | 542820.97 | 3694330.93 | 7.81 | C\L LEVEE |
| 265 | 542728.07 | 3694307.45 | 7.93 | C\L LEVEE |
| 266 | 542723.87 | 3694306.35 | 8.58 | C\L LEVEE |
| 267 | 542670.14 | 3694294.77 | 8.19 | C\L LEVEE |
| 268 | 542627.90 | 3694283.21 | 7.53 | C\L LEVEE |
| 269 | 542625.49 | 3694280.61 | 7.39 | C\L LEVEE |
| 270 | 542626.38 | 3694275.73 | 7.28 | C\L LEVEE-END |
| 271 | 542671.93 | 3694287.79 | 4.94 | TOE-END FLODWALL |
| 272 | 542671.45 | 3694287.25 | 12.49 | END CONC FLDWALL |
| 273 | 542629.44 | 3694277.76 | 12.67 | TOP CONC FLDWALL |
| 274 | 542627.80 | 3694277.24 | 12.53 | TOP CONC FLDWALL |
| 275 | 542628.17 | 3694275.72 | 12.55 | TOP CONC FLDWALL |
| 276 | 542597.02 | 3694268.21 | 12.44 | TOP CONC FLDWALL |
| 277 | 542596.62 | 3694267.86 | 12.53 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| 278 | 542591.60 | 3694266.72 | 12.57 | TOP CONC FLDWALL |
| 279 | 542587.92 | 3694281.36 | 12.53 | TOP CONC FLDWALL |
| 280 | 542588.09 | 3694281.73 | 13.28 | TOP CONC FLDWALL |
| 281 | 542586.86 | 3694283.21 | 13.31 | END CONC FLDWALL |
| 282 | 542587.78 | 3694284.09 | 3.09 | TOE FLDGATE |
| 283 | 542583.79 | 3694299.50 | 3.07 | TOE FLDGATE |
| 284 | 542583.63 | 3694300.05 | 13.28 | END CONC FLDWALL |
| 285 | 542582.82 | 3694301.67 | 13.31 | TOP CONC FLDWALL |
| 286 | 542582.72 | 3694301.90 | 12.58 | TOP CONC FLDWALL |
| 287 | 542581.44 | 3694307.56 | 12.51 | TOP CONC FLDWALL |
| 288 | 542581.48 | 3694308.09 | 13.38 | TOP CONC FLDWALL |
| 289 | 542578.04 | 3694325.16 | 13.23 | TOP CONC FLDWALL |
| 290 | 542576.09 | 3694334.32 | 13.10 | END CONC FLDWALL |
| 291 | 542576.01 | 3694334.54 | 10.51 | TOE-FLDWALL |
| 292 | 542827.67 | 3694414.77 | 2.35 | C\L FRANCE ROAD |
| 293 | 542801.48 | 3694408.00 | 2.41 | C\L FRANCE ROAD |
| 294 | 542775.19 | 3694401.46 | 2.70 | C\L FRANCE ROAD |
| 295 | 542749.30 | 3694395.00 | 3.19 | C\L FRANCE ROAD |
| 296 | 542723.03 | 3694388.44 | 3.84 | C\L FRANCE ROAD |
| 297 | 542697.36 | 3694381.99 | 4.90 | C\L FRANCE ROAD |
| 298 | 542671.54 | 3694375.55 | 6.32 | C\L FRANCE ROAD |
| 299 | 542645.25 | 3694369.13 | 7.79 | C\L FRANCE ROAD |
| 300 | 542619.64 | 3694362.73 | 9.17 | C\L FRANCE ROAD |
| 301 | 542594.62 | 3694356.56 | 10.22 | C\L FRANCE ROAD |
| 302 | 542568.11 | 3694349.66 | 10.62 | C\L FRANCE ROAD |
| 303 | 542555.35 | 3694346.33 | 2.60 | C\L FRANCE ROAD |
| 304 | 542541.09 | 3694343.20 | 2.26 | C\L FRANCE ROAD |
| 305 | 542538.76 | 3694342.28 | 10.56 | C\L FRANCE ROAD |
| 306 | 542528.23 | 3694340.00 | 9.70 | C\L FRANCE ROAD |
| 307 | 542498.23 | 3694332.35 | 7.80 | C\L FRANCE ROAD |
| 308 | 542458.20 | 3694321.88 | 5.43 | C\L FRANCE ROAD |
| 309 | 542454.06 | 3694321.09 | 2.10 | C\L FRANCE ROAD |
| 310 | 542439.30 | 3694318.15 | 0.94 | C\L FRANCE ROAD |
| 311 | 542581.62 | 3694334.54 | 10.43 | C\L LEVEE |
| 312 | 542557.02 | 3694433.20 | 10.94 | C\L LEVEE |
| 313 | 542533.78 | 3694528.97 | 11.01 | C\L LEVEE |
| 314 | 542507.21 | 3694625.98 | 10.80 | C\L LEVEE |
| 315 | 542482.02 | 3694723.23 | 10.96 | C\L LEVEE |
| 316 | 542458.93 | 3694818.22 | 10.74 | C\L LEVEE |
| 317 | 542434.64 | 3694916.01 | 10.47 | C\L LEVEE |
| 318 | 542426.71 | 3694952.37 | 9.95 | C\L LEVEE |
| 319 | 542415.52 | 3694983.29 | 10.03 | C\L LEVEE |
| 320 | 542412.83 | 3695000.09 | 10.23 | C\L LEVEE |
| 321 | 542412.54 | 3695003.75 | 9.89 | TOE-FLDWALL |
| 322 | 542412.54 | 3695004.06 | 13.08 | END CONC FLDWALL |
| 323 | 542410.94 | 3695010.63 | 13.87 | END CONC FLDWALL |
| 324 | 542411.32 | 3695009.06 | 13.89 | TOP CONC FLDWALL |
| 325 | 542411.39 | 3695008.72 | 13.13 | TOP CONC FLDWALL |
| 326 | 542410.71 | 3695011.15 | 6.28 | TOE FLDGATE |
| 327 | 542404.42 | 3695036.53 | 6.26 | TOE FLDGATE |
| 328 | 542404.23 | 3695037.10 | 13.84 | END CONC FLDWALL |
| 329 | 542402.73 | 3695043.46 | 13.07 | END CONC FLDWALL |

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| 330 | 542403.85 | 3695038.79 | 13.82 | TOP CONC FLDWALL |
| 331 | 542403.81 | 3695039.05 | 13.10 | TOP CONC FLDWALL |
| 332 | 542402.41 | 3695043.48 | 9.15 | TOE FLDWALL |
| 333 | 542400.95 | 3695044.87 | 9.83 | C\L LEVEE |
| 334 | 542397.93 | 3695059.19 | 10.30 | C\L LEVEE |
| 335 | 542375.37 | 3695155.03 | 10.81 | C\L LEVEE |
| 336 | 542351.64 | 3695248.94 | 10.91 | C\L LEVEE |
| 337 | 542339.06 | 3695301.12 | 11.37 | C\L LEVEE |
| 338 | 542330.30 | 3695342.10 | 10.48 | C\L LEVEE |
| 339 | 542316.91 | 3695415.26 | 10.04 | C\L LEVEE |
| 340 | 542309.55 | 3695439.22 | 9.69 | C\L LEVEE |
| 341 | 542301.53 | 3695470.39 | 10.48 | C\L LEVEE |
| 342 | 542298.02 | 3695484.97 | 10.79 | C\L LEVEE-END PROFIL |
| 343 | 542194.93 | 3695876.37 | 6.80 | TOE FLDWALL |
| 344 | 542194.26 | 3695876.77 | 13.02 | TOP CONC FLDWALL |
| LA1054-WM | 549412.38 | 3694521.34 | 11.92 | TOP BLDG CINDER |
| 346 | 544175.86 | 3694342.97 | 1.72 | TOE |
| 347 | 544176.49 | 3694348.47 | 2.90 | TOP |
| 348 | 544176.78 | 3694351.63 | 3.65 | TOP OF RAIL |
| 349 | 544177.53 | 3694356.31 | 3.69 | TOP OF RAIL |
| 350 | 544178.15 | 3694358.66 | 2.99 | TOP |
| 351 | 544179.76 | 3694365.80 | 0.63 | TOE |
| 352 | 544180.70 | 3694368.44 | 0.51 | TOP DITCH |
| 353 | 544181.37 | 3694370.11 | 0.04 | WE |
| 354 | 544183.04 | 3694386.43 | -0.04 | WE |
| 355 | 544195.72 | 3694377.71 | -2.44 | C\L DITCH |
| 356 | 544184.77 | 3694393.25 | 2.42 | TOP DITCH |
| 357 | 544185.85 | 3694402.70 | 3.59 | PL |
| 358 | 544188.14 | 3694411.22 | 3.42 | EDGE ASPHALT ROAD |
| 359 | 544189.93 | 3694423.17 | 3.29 | C\L ROAD |
| 360 | 544192.74 | 3694435.67 | 3.15 | EDGE ASPHALT ROAD |
| 361 | 544194.75 | 3694445.61 | 2.74 | TOP DITCH |
| 362 | 543258.67 | 3694433.59 | 12.98 | END CONC FLDWALL |
| 363 | 543256.32 | 3694431.96 | 3.51 | TOE FLDGATE |
| 364 | 543218.66 | 3694422.67 | 3.54 | TOE FLDGATE |
| 365 | 543202.85 | 3694418.75 | 3.54 | TOE FLDGATE |
| 366 | 543165.27 | 3694409.36 | 3.42 | TOE FLDGATE |
| 367 | 543216.40 | 3694422.35 | 12.89 | END CONC FLDWALL |
| 368 | 543204.96 | 3694419.52 | 12.94 | END CONC FLDWALL |
| 369 | 543162.66 | 3694409.01 | 12.89 | END CONC FLDWALL |
| 370 | 543109.54 | 3694396.85 | 12.92 | END CONC FLDWALL |
| 371 | 543109.19 | 3694396.16 | 4.78 | TOE FLDWALL |

# Appendix 5
# Railroad Detail

## Topography

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 102 | 544188.86 | 3680182.60 | -0.20 | EDGE CONC ABUTEMENT |
| 103 | 544185.00 | 3680193.80 | -5.39 | TOP CONC RETAIN WALL |
| 104 | 544184.76 | 3680194.05 | -7.30 | TOE |
| 105 | 544181.76 | 3680203.29 | -7.43 | TOP CURB |
| 106 | 544181.46 | 3680203.79 | -8.03 | EDGE ROAD |
| 107 | 544173.46 | 3680224.79 | -7.41 | EDGE ROAD |
| 108 | 544173.54 | 3680225.24 | -6.77 | TOP CURB |
| 109 | 544171.57 | 3680230.33 | -6.66 | EDGE CONC PIER |
| 110 | 544169.41 | 3680235.63 | -6.86 | EDGE CONC PIER |
| 111 | 544168.98 | 3680237.29 | -6.97 | TOP CURB |
| 112 | 544168.65 | 3680237.89 | -7.61 | EDGE ROAD |
| 113 | 544155.79 | 3680270.77 | -7.60 | EDGE ROAD |
| 114 | 544155.25 | 3680272.04 | -6.95 | TOP CURB |
| 116 | 544154.03 | 3680274.46 | -6.81 | EDGE CONC PIER |
| 117 | 544152.36 | 3680279.24 | -6.94 | EDGE CONC PIER |
| 118 | 544151.46 | 3680281.24 | -6.93 | TOP CURB |
| 119 | 544151.13 | 3680282.10 | -7.55 | EDGE ROAD |
| 120 | 544137.53 | 3680315.64 | -7.51 | EDGE ROAD |
| 121 | 544137.49 | 3680316.03 | -6.88 | TOP CURB |
| 122 | 544136.69 | 3680318.62 | -6.90 | EDGE CONC PIER |
| 123 | 544134.59 | 3680323.95 | -7.13 | EDGE CONC PIER |
| 124 | 544132.15 | 3680330.42 | -7.32 | TOP CURB |
| 125 | 544131.84 | 3680331.03 | -7.95 | EDGE ROAD |
| 126 | 544122.79 | 3680354.57 | -8.45 | EDGE ROAD |
| 127 | 544122.69 | 3680355.18 | -7.82 | TOP CURB |
| 128 | 544116.09 | 3680370.53 | -0.44 | EDGE CONC ABUTEMENT |
| 133 | 543730.78 | 3681338.42 | 8.21 | TOP CONC ABUTEMENT |
| 134 | 543730.32 | 3681338.97 | 3.92 | EDGE CONC ABUTEMENT |
| 135 | 543728.43 | 3681343.71 | 1.87 | SLOPE |
| 136 | 543726.00 | 3681349.69 | 0.59 | TOP CONC WALL |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 137 | 543725.61 | 3681350.85 | -0.19 | WES |
| 138 | 543725.49 | 3681350.13 | -4.53 | TOE |
| 139 | 543719.80 | 3681365.24 | -6.53 | CANAL BOTTOM |
| 140 | 543713.31 | 3681381.32 | -5.50 | CANAL BOTTOM |
| 142 | 543700.99 | 3681412.34 | -3.23 | CANAL BOTTOM |
| 143 | 543694.71 | 3681428.94 | -2.01 | CANAL BOTTOM |
| 144 | 543689.37 | 3681442.95 | -1.10 | CANAL BOTTOM |
| 145 | 543684.96 | 3681454.03 | -0.17 | WES |
| 146 | 543682.16 | 3681461.77 | 2.05 | SLOPE |
| 147 | 543680.28 | 3681465.58 | 2.62 | EDGE CONC PIER |
| 148 | 543680.15 | 3681465.89 | 5.82 | TOP |
| 149 | 543676.48 | 3681471.78 | 5.50 | SLOPE |
| 150 | 543673.54 | 3681483.25 | 8.14 | TOP CONC ABUTEMENT |
| 151 | 543610.09 | 3681653.76 | 0.97 | EDGE CONC ABUTEMENT |
| 152 | 543609.11 | 3681656.13 | 1.10 | TOP |
| 153 | 543601.45 | 3681675.13 | -6.29 | TOE |
| 154 | 543601.29 | 3681676.32 | -6.48 | TOP CURB |
| 155 | 543601.10 | 3681676.85 | -7.00 | TOE CURB |
| 156 | 543599.57 | 3681680.97 | -7.26 | EDGE CONC PIER |
| 157 | 543596.71 | 3681685.09 | -7.57 | EDGE CONC PIER |
| 158 | 543595.34 | 3681688.26 | -7.65 | TOP CURB |
| 159 | 543595.09 | 3681688.71 | -8.25 | EDGE ROAD |
| 160 | 543583.77 | 3681717.46 | -7.74 | EDGE ROAD |
| 161 | 543583.55 | 3681718.04 | -7.21 | TOP CURB |
| 162 | 543581.03 | 3681724.08 | -7.09 | EDGE CONC PIER |
| 163 | 543580.31 | 3681729.37 | -6.82 | EDGE CONC PIER |
| 164 | 543577.88 | 3681736.41 | -7.31 | TOP CURB |
| 165 | 543578.72 | 3681733.08 | 6.17 | LOW CORD |
| 166 | 543577.32 | 3681737.01 | -7.83 | EDGE ROAD |
| 167 | 543566.40 | 3681764.99 | -7.83 | EDGE ROAD |
| 168 | 543565.93 | 3681765.88 | -7.39 | TOP CURB |
| 169 | 543564.74 | 3681768.19 | -7.28 | EDGE CONC PIER |
| 170 | 543562.85 | 3681773.10 | -6.66 | EDGE CONC PIER |
| 171 | 543562.99 | 3681773.24 | -6.67 | EDGE CONC PIER |
| 172 | 543559.52 | 3681781.53 | -6.67 | TOE |
| 173 | 543553.32 | 3681797.56 | 0.02 | TOP |
| 174 | 543552.20 | 3681800.52 | 0.60 | EDGE CONC ABUTEMENT |
| 200 | 542700.86 | 3688757.16 | 0.84 | TOP |
| 201 | 542696.84 | 3688763.15 | -2.69 | SLOPE |
| 202 | 542690.95 | 3688771.72 | -4.79 | SLOPE |
| 203 | 542683.22 | 3688783.11 | -5.82 | SLOPE |
| 204 | 542674.61 | 3688793.13 | -5.95 | SLOPE |
| 205 | 542665.50 | 3688804.69 | -9.00 | TOE |
| 206 | 542662.17 | 3688808.69 | -9.30 | TOP CONC WALL |
| 207 | 542660.41 | 3688810.50 | -9.32 | TOP CONC WALL |
| 208 | 542659.52 | 3688810.98 | -14.84 | WES |
| 209 | 542659.53 | 3688811.24 | -16.15 | TOE |
| 210 | 542648.14 | 3688824.74 | -16.74 | CANAL BOTTOM |
| 211 | 542633.65 | 3688840.39 | -16.64 | CANAL BOTTOM |
| 212 | 542625.78 | 3688849.06 | -16.23 | TOE |
| 213 | 542625.33 | 3688849.77 | -16.24 | TOE |
| 214 | 542625.31 | 3688849.95 | -14.88 | WES |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 215 | 542625.14 | 3688850.07 | -9.33 | TOP CONC WALL |
| 216 | 542621.30 | 3688853.24 | -8.76 | SLOPE |
| 217 | 542612.71 | 3688861.15 | -6.15 | E WOODEN ABUTEMENT |
| 218 | 542612.97 | 3688861.27 | 1.11 | TOP WOODEN ABUTEMENT |
| 221 | 542567.84 | 3688885.92 | 2.51 | C/L ROAD |
| 239 | 544514.60 | 3687331.22 | 3.25 | TOP CONC ABUTEMENT |
| 240 | 544514.22 | 3687331.20 | -13.18 | EDGE CONC ABUTEMENT |
| 241 | 544510.46 | 3687328.00 | -14.66 | EDGE SIDEWALK |
| 242 | 544502.88 | 3687322.40 | -14.83 | EDGE SIDEWALK |
| 243 | 544498.69 | 3687319.24 | -16.78 | TOE |
| 244 | 544497.08 | 3687318.35 | -16.67 | TOP CURB |
| 245 | 544495.75 | 3687317.44 | -16.75 | TOP CURB |
| 246 | 544495.14 | 3687316.82 | -17.44 | EDGE ROAD |
| 247 | 544459.53 | 3687289.73 | -16.49 | EDGE ROAD |
| 248 | 544459.22 | 3687289.36 | -15.83 | TOP CURB |
| 249 | 544458.08 | 3687288.65 | -15.79 | TOP CURB |
| 250 | 544451.55 | 3687284.17 | -15.73 | TOP CURB |
| 251 | 544449.40 | 3687282.34 | -15.65 | TOP CURB |
| 252 | 544449.12 | 3687281.78 | -16.19 | EDGE ROAD |
| 253 | 544413.93 | 3687255.39 | -15.93 | EDGE ROAD |
| 254 | 544413.22 | 3687254.83 | -15.34 | TOP CURB |
| 255 | 544412.48 | 3687254.31 | -15.37 | TOP CURB |
| 256 | 544406.43 | 3687249.59 | -14.50 | EDGE SIDEWALK |
| 257 | 544400.54 | 3687245.06 | -14.48 | EDGE SIDEWALK |
| 258 | 544395.81 | 3687241.88 | -13.46 | EDGE CONC ABUTEMENT |
| 259 | 544395.99 | 3687241.34 | 3.33 | TOP CONC ABUTEMENT |
| 261 | 542501.60 | 3689234.46 | 1.08 | TOP |
| 262 | 542508.06 | 3689246.18 | -2.87 | SLOPE |
| 263 | 542513.69 | 3689261.32 | -6.78 | SLOPE |
| 264 | 542518.93 | 3689272.90 | -9.38 | TOE |
| 265 | 542519.86 | 3689274.24 | -9.71 | TOP CONC WALL |
| 266 | 542521.11 | 3689276.22 | -9.79 | TOP CONC WALL |
| 267 | 542521.32 | 3689277.33 | -14.21 | WES |
| 268 | 542521.01 | 3689277.38 | -16.84 | TOE |
| 269 | 542529.69 | 3689295.68 | -17.22 | CANAL BOTTOM |
| 270 | 542536.66 | 3689311.24 | -16.65 | TOE |
| 271 | 542536.62 | 3689311.13 | -14.17 | WES |
| 272 | 542536.84 | 3689310.89 | -9.82 | TOP CONC WALL |
| 273 | 542537.22 | 3689312.25 | -9.82 | TOP CONC WALL |
| 274 | 542537.38 | 3689312.27 | -10.69 | TOE |
| 275 | 542547.15 | 3689336.24 | -9.95 | TOE |
| 276 | 542552.40 | 3689353.36 | 0.51 | TOP |
| 279 | 542513.63 | 3689207.94 | 1.31 | TOP |
| 280 | 542522.91 | 3689202.22 | -3.20 | SLOPE |
| 281 | 542523.27 | 3689202.32 | -4.63 | SLOPE |
| 282 | 542529.16 | 3689198.66 | -6.36 | SLOPE |
| 283 | 542536.17 | 3689194.52 | -9.51 | TOE |
| 284 | 542539.75 | 3689193.02 | -9.63 | TOP CONC WALL |
| 285 | 542542.17 | 3689192.06 | -9.60 | TOP CONC WALL |
| 286 | 542541.90 | 3689191.69 | -14.12 | WES |
| 287 | 542541.87 | 3689191.99 | -16.56 | TOE |
| 288 | 542556.46 | 3689183.21 | -16.97 | CANAL BOTTOM |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 289 | 542570.63 | 3689174.80 | -16.58 | TOE |
| 290 | 542570.49 | 3689174.95 | -14.16 | WES |
| 291 | 542571.34 | 3689175.00 | -9.56 | TOP CONC WALL |
| 292 | 542573.33 | 3689174.48 | -9.66 | TOP CONC WALL |
| 293 | 542576.67 | 3689171.69 | -9.61 | TOE |
| 294 | 542590.34 | 3689164.69 | -8.91 | SLOPE |
| 295 | 542598.32 | 3689160.39 | -7.98 | SLOPE |
| 296 | 542607.99 | 3689154.79 | -2.75 | SLOPE |
| 297 | 542610.23 | 3689152.03 | 0.77 | TOP |
| 300 | 542576.96 | 3689028.25 | 0.32 | TOP CONC ABUTEMENT |
| 301 | 542578.11 | 3689028.49 | -9.57 | EDGE CONC ABUTEMENT |
| 302 | 542580.34 | 3689028.37 | -9.26 | TOP CONC WALL |
| 303 | 542582.68 | 3689028.18 | -9.31 | TOP CONC WALL |
| 304 | 542582.50 | 3689027.83 | -13.96 | WES |
| 305 | 542582.63 | 3689027.80 | -15.91 | TOE |
| 306 | 542596.52 | 3689026.48 | -16.77 | CANAL BOTTOM |
| 307 | 542608.55 | 3689025.74 | -16.34 | TOE |
| 308 | 542607.53 | 3689026.06 | -14.10 | WES |
| 309 | 542608.54 | 3689025.71 | -9.50 | TOP CONC WALL |
| 310 | 542609.97 | 3689025.45 | -9.53 | TOP CONC WALL |
| 311 | 542615.06 | 3689025.62 | -9.44 | EDGE CONC ABUTEMENT |
| 312 | 542615.21 | 3689025.55 | 0.23 | TOP CONC ABUTEMENT |
| 314 | 546150.25 | 3688572.31 | 4.11 | TOP CONC ABUTEMENT |
| 315 | 546151.21 | 3688572.75 | -3.79 | EDGE CONC ABUTEMENT |
| 316 | 546155.16 | 3688576.20 | -4.19 | TOP |
| 317 | 546162.39 | 3688581.86 | -8.03 | SLOPE |
| 318 | 546169.59 | 3688586.63 | -8.96 | SLOPE |
| 319 | 546177.27 | 3688593.24 | -12.16 | TOE |
| 320 | 546182.77 | 3688597.08 | -12.95 | WES |
| 321 | 546187.77 | 3688601.03 | -14.23 | CANAL BOTTOM |
| 322 | 546194.89 | 3688606.11 | -15.26 | CANAL BOTTOM |
| 323 | 546199.56 | 3688609.75 | -14.98 | CANAL BOTTOM |
| 324 | 546207.39 | 3688615.40 | -13.07 | WES |
| 325 | 546211.30 | 3688618.41 | -12.76 | TOE |
| 326 | 546217.33 | 3688623.08 | -11.38 | SLOPE |
| 327 | 546222.50 | 3688626.73 | -9.08 | SLOPE |
| 328 | 546222.13 | 3688626.92 | -9.06 | SLOPE |
| 329 | 546235.00 | 3688636.44 | -4.43 | TOP |
| 330 | 546241.59 | 3688641.66 | -5.19 | EDGE CONC ABUTEMENT |
| 331 | 546242.08 | 3688642.17 | 4.21 | TOP CONC ABUTEMENT |
| 342 | 548700.81 | 3688525.15 | 13.77 | TOP CONC ABUTEMENT |
| 343 | 548699.92 | 3688525.18 | 5.99 | TOP CONC ABUTEMENT |
| 344 | 548709.40 | 3688524.15 | 1.75 | SLOPE |
| 345 | 548718.36 | 3688523.44 | -3.87 | TOE |
| 346 | 548721.48 | 3688523.39 | -3.97 | TOP CURB |
| 347 | 548722.19 | 3688523.28 | -4.62 | EDGE SIDEWALK |
| 348 | 548727.39 | 3688522.80 | -4.72 | EDGE CONC PIER |
| 349 | 548731.93 | 3688522.45 | -4.93 | EDGE CONC PIER |
| 350 | 548732.66 | 3688522.52 | -4.95 | TOP CURB |
| 351 | 548733.07 | 3688522.48 | -5.53 | EDGE ROAD |
| 352 | 548762.49 | 3688520.19 | -5.18 | EDGE ROAD |
| 353 | 548763.58 | 3688520.08 | -4.54 | TOP CURB |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 354 | 548764.55 | 3688519.82 | -4.54 | EDGE CONC PIER |
| 355 | 548769.33 | 3688519.07 | -4.60 | EDGE CONC PIER |
| 356 | 548770.41 | 3688518.94 | -4.51 | TOP CURB |
| 357 | 548770.84 | 3688518.93 | -5.24 | EDGE ROAD |
| 358 | 548800.64 | 3688516.98 | -5.68 | EDGE ROAD |
| 359 | 548801.00 | 3688517.02 | -5.02 | TOP CURB |
| 360 | 548802.17 | 3688516.79 | -5.06 | EDGE CONC PIER |
| 361 | 548806.97 | 3688516.61 | -4.53 | EDGE CONC PIER |
| 362 | 548811.44 | 3688516.10 | -4.37 | EDGE SIDEWALK |
| 363 | 548812.12 | 3688516.30 | -3.98 | TOP CURB |
| 364 | 548812.59 | 3688516.02 | -4.42 | TOE |
| 365 | 548814.37 | 3688515.98 | -4.59 | TOE |
| 366 | 548823.23 | 3688515.12 | 0.28 | SLOPE |
| 367 | 548833.16 | 3688514.34 | 6.18 | EDGE CONC ABUTEMENT |
| 368 | 548833.53 | 3688513.80 | 13.49 | TOP CONC ABUTEMENT |
| 381 | 557982.67 | 3688500.89 | 5.20 | TOP CONC ABUTEMENT |
| 382 | 557982.76 | 3688501.52 | -17.76 | EDGE CONC ABUTEMENT |
| 383 | 557990.91 | 3688510.40 | -18.34 | TOP CURB |
| 384 | 557991.50 | 3688509.59 | -22.76 | EDGE ROAD |
| 385 | 558008.15 | 3688529.62 | -18.22 | EDGE ROAD |
| 386 | 558008.80 | 3688530.26 | -17.61 | TOP CURB |
| 387 | 558016.97 | 3688540.12 | -17.11 | CL/ CL BENT |
| 388 | 558025.67 | 3688549.23 | -17.55 | TOP CURB |
| 389 | 558026.13 | 3688549.73 | -18.22 | EDGE ROAD |
| 390 | 558045.29 | 3688567.55 | -20.19 | EDGE ROAD |
| 391 | 558043.78 | 3688569.22 | -18.36 | EDGE ROAD |
| 392 | 558047.57 | 3688573.95 | -18.29 | EDGE SIDEWALK |
| 393 | 558051.65 | 3688578.33 | -17.89 | EDGE CONC ABUTEMENT |
| 394 | 558051.88 | 3688578.69 | 5.84 | TOP CONC ABUTEMENT |
| 421 | 537264.03 | 3663070.99 | 1.33 | TOP WOOD RETAINWALL |
| 422 | 537264.33 | 3663070.52 | -0.17 | TOP WOOD BENT |
| 423 | 537264.42 | 3663069.72 | -0.13 | TOP WOOD BENT |
| 424 | 537264.19 | 3663069.73 | -6.52 | E WOODEN ABUTEMENT |
| 425 | 537264.60 | 3663063.23 | -9.87 | SLOPE |
| 426 | 537264.67 | 3663057.41 | -10.80 | SLOPE |
| 427 | 537264.86 | 3663056.04 | -11.38 | WES |
| 428 | 537265.04 | 3663051.42 | -13.70 | CANAL BOTTOM |
| 429 | 537265.08 | 3663049.36 | -15.61 | CANAL BOTTOM |
| 430 | 537266.06 | 3663039.65 | -15.29 | CANAL BOTTOM |
| 431 | 537266.84 | 3663028.96 | -13.65 | CANAL BOTTOM |
| 432 | 537266.96 | 3663024.35 | -11.41 | WES |
| 433 | 537267.63 | 3663020.31 | -9.61 | SLOPE |
| 434 | 537267.73 | 3663013.32 | -5.73 | SLOPE |
| 435 | 537268.53 | 3663004.61 | -3.62 | E WOODEN ABUTEMENT |
| 436 | 537268.31 | 3663004.45 | 0.11 | TOP WOOD BENT |
| 437 | 537268.60 | 3663003.19 | 0.17 | TOP WOOD BENT |
| 438 | 537269.08 | 3663002.71 | 1.68 | TOP WOOD RETAINWALL |
| 442 | 537271.95 | 3662705.12 | 4.18 | TOP CONC RETAIN WALL |
| 443 | 537271.65 | 3662704.84 | 0.21 | TOP CONC ABUTEMENT |
| 444 | 537271.80 | 3662699.48 | 0.25 | TOP CONC ABUTEMENT |
| 445 | 537272.44 | 3662699.36 | -5.51 | EDGE CONC ABUTEMENT |
| 446 | 537273.23 | 3662681.26 | -9.14 | SLOPE |

| Name | Northing | Easting | Elevation | Code |
| --- | --- | --- | --- | --- |
| 447 | 537273.17 | 3662675.46 | -10.56 | SLOPE |
| 448 | 537274.76 | 3662654.67 | -13.15 | SLOPE |
| 449 | 537275.65 | 3662638.94 | -14.71 | TOE |
| 450 | 537275.79 | 3662638.25 | -14.17 | TOP CURB |
| 451 | 537275.74 | 3662637.76 | -14.56 | EDGE ROAD |
| 452 | 537277.62 | 3662606.43 | -14.17 | EDGE ROAD |
| 453 | 537277.88 | 3662603.45 | -15.10 | TOE |
| 454 | 537278.80 | 3662590.28 | -15.21 | SLOPE |
| 455 | 537279.01 | 3662590.03 | -14.17 | EDGE ROAD |
| 456 | 537280.62 | 3662564.80 | -14.56 | EDGE ROAD |
| 457 | 537280.68 | 3662564.33 | -14.07 | TOP CURB |
| 458 | 537280.83 | 3662561.50 | -14.30 | TOE |
| 459 | 537282.23 | 3662541.92 | -10.98 | SLOPE |
| 460 | 537282.68 | 3662536.10 | -8.68 | SLOPE |
| 461 | 537283.82 | 3662525.42 | -7.61 | SLOPE |
| 462 | 537283.96 | 3662518.47 | -5.67 | EDGE CONC ABUTEMENT |
| 463 | 537284.04 | 3662518.43 | 0.82 | TOP CONC ABUTEMENT |
| 464 | 537284.50 | 3662513.44 | 0.80 | TOP CONC ABUTEMENT |
| 465 | 537284.27 | 3662512.87 | 4.80 | TOP CONC RETAIN WALL |
| 466 | 537284.41 | 3662511.93 | 4.78 | TOP CONC RETAIN WALL |

## Top Rail Elevations

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 100 | 544187.43 | 3680113.98 | 10.81 | TOP RAIL |
| 101 | 544172.11 | 3680153.10 | 10.77 | TOP RAIL/E RR BRIDGE |
| 129 | 544094.97 | 3680349.12 | 10.78 | TOP RAIL/E RR BRIDGE |
| 130 | 543922.45 | 3680785.07 | 10.55 | TOP RAIL |
| 131 | 543708.21 | 3681329.43 | 9.52 | TOP RAIL/E RR BRIDGE |
| 175 | 543664.31 | 3681480.27 | 9.34 | TOP RAIL/E RR BRIDGE |
| 176 | 543599.82 | 3681644.02 | 9.20 | TOP RAIL/E RR BRIDGE |
| 177 | 543539.81 | 3681795.79 | 8.82 | TOP RAIL/E RR BRIDGE |
| 178 | 543314.77 | 3682327.41 | 6.76 | TOP RAIL |
| 179 | 543021.60 | 3683072.44 | 3.79 | TOP RAIL |
| 180 | 542834.49 | 3683546.45 | 2.50 | TOP RAIL |
| 181 | 542647.21 | 3684009.73 | 0.95 | TOP RAIL |
| 182 | 542543.41 | 3684282.47 | 0.36 | TOP RAIL |
| 183 | 542522.23 | 3684412.47 | 0.19 | TOP RAIL |
| 184 | 542519.19 | 3684634.81 | 0.47 | TOP RAIL |
| 185 | 542558.95 | 3685160.38 | 0.56 | TOP RAIL |
| 186 | 542592.48 | 3685568.11 | -0.07 | TOP RAIL |
| 187 | 542630.62 | 3686029.34 | -0.48 | TOP RAIL |
| 188 | 542651.02 | 3686281.58 | -1.14 | TOP RAIL |
| 189 | 542693.06 | 3686802.35 | -1.31 | TOP RAIL |
| 190 | 542729.14 | 3687257.81 | -1.25 | TOP RAIL |
| 191 | 542753.08 | 3687559.77 | -1.09 | TOP RAIL |
| 192 | 542793.49 | 3688079.97 | -0.24 | TOP RAIL |
| 193 | 542783.52 | 3688492.01 | -0.08 | TOP RAIL |
| 194 | 542756.74 | 3688618.74 | 0.64 | TOP RAIL |
| 195 | 542754.42 | 3688625.20 | 0.67 | TOP RAIL/E ROAD |
| 196 | 542739.58 | 3688662.93 | 1.11 | TOP RAIL/E ROAD |
| 197 | 542751.99 | 3688646.27 | 0.96 | TOP RAIL/CL ROAD |
| 198 | 542693.00 | 3688750.26 | 2.63 | TOP RAIL/E RR BRIDGE |
| 199 | 542601.57 | 3688858.20 | 2.85 | TOP RAIL/E RR BRIDGE |
| 220 | 542590.31 | 3688867.87 | 2.73 | TOP RAIL/E ROAD |
| 222 | 542546.92 | 3688900.81 | 2.31 | TOP RAIL/E ROAD |
| 223 | 542492.83 | 3688932.51 | 1.74 | TOP RAIL |
| 224 | 542440.36 | 3688955.59 | 1.39 | TOP RAIL |
| 225 | 542375.71 | 3688974.65 | 0.96 | TOP RAIL |
| 226 | 542114.42 | 3689005.37 | 0.01 | TOP RAIL |
| 227 | 536662.24 | 3688222.62 | 3.16 | TOP RAIL |
| 228 | 536590.57 | 3688198.57 | 3.29 | TOP RAIL |
| 229 | 536308.45 | 3688123.57 | 3.31 | TOP RAIL/E ROAD |
| 230 | 546009.99 | 3688458.17 | 4.24 | TOP RAIL |
| 231 | 545610.27 | 3688154.08 | 2.48 | TOP RAIL |
| 232 | 545287.24 | 3687909.11 | 1.88 | TOP RAIL |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 233 | 545228.99 | 3687864.60 | 1.88 | TOP RAIL |
| 236 | 544821.58 | 3687554.55 | 2.76 | TOP RAIL |
| 237 | 544522.94 | 3687327.42 | 4.08 | TOP RAIL/E RR BRIDGE |
| 238 | 544522.78 | 3687327.44 | 4.08 | TOP RAIL/E RR BRIDGE |
| 278 | 542511.61 | 3689205.54 | 2.60 | TOP RAIL |
| 298 | 542608.16 | 3689150.12 | 2.44 | TOP RAIL/E RR BRIDGE |
| 333 | 546154.73 | 3688567.68 | 0.10 | TOP RAIL/E RR BRIDGE |
| 334 | 546251.02 | 3688640.69 | 5.01 | TOP RAIL/E RR BRIDGE |
| 335 | 546308.66 | 3688685.12 | 4.86 | TOP RAIL |
| 336 | 546413.53 | 3688676.19 | 5.38 | TOP RAIL |
| 337 | 546926.17 | 3688643.98 | 6.16 | TOP RAIL |
| 338 | 547586.96 | 3688589.42 | 8.37 | TOP RAIL |
| 339 | 548062.97 | 3688550.57 | 10.46 | TOP RAIL |
| 340 | 548695.15 | 3688504.02 | 12.09 | TOP RAIL/E RR BRIDGE |
| 341 | 548835.18 | 3688492.88 | 11.97 | TOP RAIL/E RR BRIDGE |
| 370 | 549554.40 | 3688429.53 | 11.16 | TOP RAIL |
| 371 | 550585.39 | 3688345.72 | 9.43 | TOP RAIL |
| 372 | 551114.12 | 3688287.60 | 9.02 | TOP RAIL |
| 373 | 551988.13 | 3688216.08 | 8.61 | TOP RAIL |
| 374 | 552545.38 | 3688170.52 | 8.31 | TOP RAIL |
| 375 | 553079.66 | 3688126.76 | 7.61 | TOP RAIL |
| 376 | 553714.02 | 3688074.89 | 7.15 | TOP RAIL |
| 377 | 554338.21 | 3688023.82 | 6.85 | TOP RAIL |
| 378 | 554957.69 | 3687973.13 | 6.00 | TOP RAIL |
| 379 | 555588.04 | 3687921.40 | 5.99 | TOP RAIL |
| 380 | 556047.44 | 3687883.88 | 5.81 | TOP RAIL |
| 415 | 537249.93 | 3663186.15 | 1.49 | TOP RAIL |
| 416 | 537256.70 | 3663071.38 | 2.27 | TOP RAIL/E RR BRIDGE |
| 417 | 537260.97 | 3663002.41 | 2.50 | TOP RAIL/E RR BRIDGE |
| 439 | 537267.64 | 3662899.77 | 3.04 | TOP RAIL |
| 440 | 537280.37 | 3662706.97 | 4.06 | TOP RAIL/E RR BRIDGE |
| 441 | 537293.20 | 3662512.75 | 4.57 | TOP RAIL/E RR BRIDGE |
| 468 | 537305.43 | 3662313.84 | 4.53 | TOP RAIL |
| 469 | 537320.41 | 3662087.92 | 3.05 | TOP RAIL |
| 470 | 537336.97 | 3661829.00 | 1.79 | TOP RAIL |
| 471 | 537354.84 | 3661400.48 | 0.99 | TOP RAIL |
| 472 | 537393.29 | 3660601.29 | 0.19 | TOP RAIL |
| 473 | 537410.34 | 3660335.31 | 0.04 | TOP RAIL |
| 474 | 537558.66 | 3658728.86 | 1.64 | TOP RAIL |
| 475 | 537552.07 | 3657971.43 | 1.81 | TOP RAIL |
| 476 | 537552.08 | 3657971.43 | 1.82 | TOP RAIL |
| 477 | 537620.60 | 3657015.35 | 3.27 | TOP RAIL |
| 478 | 537659.53 | 3656416.86 | 3.59 | TOP RAIL |
| 5000 | 542500.17 | 3689216.45 | 2.35 | TOP RAIL\EDGE ROAD |
| 5001 | 542517.12 | 3689243.01 | 2.55 | TOP RAIL\E RR BRIBGE |
| 5002 | 542532.49 | 3689272.86 | 2.54 | TOP RAIL |
| 5003 | 542549.11 | 3689315.04 | 2.47 | TOP RAIL |
| 5004 | 542559.30 | 3689349.83 | 2.46 | TOP RAIL\E RR BRIBGE |
| 5005 | 542567.85 | 3689403.22 | 1.71 | TOP RAIL |
| 5006 | 542569.41 | 3689453.38 | 1.04 | TOP RAIL |
| 5007 | 542564.40 | 3689510.76 | 0.54 | TOP RAIL |
| 5008 | 542553.55 | 3689567.64 | 0.22 | TOP RAIL |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 5009 | 542536.69 | 3689641.51 | 0.02 | TOP RAIL |
| 5010 | 542410.17 | 3690157.74 | 2.13 | TOP RAIL |
| 5011 | 542284.39 | 3690658.96 | -0.37 | TOP RAIL |
| 5012 | 542168.33 | 3691128.33 | -1.54 | TOP RAIL\EDGE ROAD |
| 5013 | 542164.89 | 3691142.44 | -1.57 | TOP RAIL\CL ROAD |
| 5014 | 542160.91 | 3691158.39 | -1.58 | TOP RAIL\EDGE ROAD |
| 5015 | 542130.86 | 3691279.34 | -1.54 | TOP RAIL\EDGE ROAD |
| 5016 | 542125.76 | 3691299.43 | -1.36 | TOP RAIL\CL ROAD |
| 5017 | 542119.80 | 3691324.57 | -1.35 | TOP RAIL\EDGE ROAD |
| 5018 | 542017.06 | 3691734.82 | -0.11 | TOP RAIL\EDGE ROAD |
| 5019 | 542014.08 | 3691746.35 | -0.15 | TOP RAIL\CL ROAD |
| 5020 | 542011.40 | 3691757.34 | 0.00 | TOP RAIL\EDGE ROAD |
| 5021 | 541882.86 | 3692273.63 | 0.02 | TOP RAIL |
| 5022 | 541746.73 | 3692820.89 | 0.63 | TOP RAIL |
| 5023 | 541627.03 | 3693303.39 | 0.16 | TOP RAIL |
| 5024 | 541440.57 | 3694054.81 | 2.20 | TOP RAIL\EDGE ROAD |
| 5025 | 541437.34 | 3694067.57 | 2.28 | TOP RAIL\CL ROAD |
| 5026 | 541434.18 | 3694080.34 | 2.28 | TOP RAIL\EDGE ROAD |
| 5027 | 541308.44 | 3694589.54 | 2.58 | TOP RAIL |
| 5028 | 541184.00 | 3695091.32 | 4.11 | TOP RAIL |
| 5029 | 541151.44 | 3695219.66 | 4.85 | TOP RAIL |
| 5030 | 541133.71 | 3695286.17 | 5.14 | TOP RAIL |
| 5031 | 541099.62 | 3695378.74 | 6.22 | TOP RAIL |
| 5032 | 541029.49 | 3695493.01 | 7.53 | TOP RAIL\E FLOODGATE |
| 5033 | 534151.89 | 3687582.04 | 9.72 | TOP RAIL\EDGE ROAD |
| 5034 | 534167.12 | 3687595.61 | 9.40 | TOP RAIL\CL ROAD |
| 5035 | 534182.60 | 3687607.73 | 9.17 | TOP RAIL\CL ROAD |
| 5036 | 534212.16 | 3687627.39 | 8.84 | TOP RAIL |
| 5037 | 534260.76 | 3687650.71 | 7.99 | TOP RAIL |
| 5038 | 534309.82 | 3687666.65 | 7.63 | TOP RAIL |
| 5039 | 534342.42 | 3687675.44 | 7.30 | TOP RAIL\EDGE ROAD |
| 5040 | 534364.94 | 3687681.14 | 7.12 | TOP RAIL\CL ROAD |
| 5041 | 534380.85 | 3687684.93 | 6.99 | TOP RAIL\EDGE ROAD |
| 5042 | 534701.09 | 3687766.71 | 5.99 | TOP RAIL\EDGE ROAD |
| 5043 | 534715.58 | 3687770.53 | 6.08 | TOP RAIL\CL ROAD |
| 5044 | 534731.84 | 3687774.62 | 5.94 | TOP RAIL\EDGE ROAD |
| 5045 | 534761.91 | 3687781.77 | 5.78 | TOP RAIL |
| 5046 | 534808.82 | 3687789.93 | 5.37 | TOP RAIL |
| 5047 | 534992.09 | 3687815.04 | 5.29 | TOP RAIL |
| 5048 | 535040.01 | 3687824.91 | 5.51 | TOP RAIL |
| 5049 | 535053.99 | 3687828.53 | 5.53 | TOP RAIL\EDGE ROAD |
| 5050 | 535075.19 | 3687834.06 | 5.47 | TOP RAIL\CL ROAD |
| 5051 | 535091.88 | 3687838.27 | 5.41 | TOP RAIL\EDGE ROAD |
| 5052 | 535226.56 | 3687872.67 | 4.81 | TOP RAIL |
| 5053 | 535309.52 | 3687887.98 | 4.79 | TOP RAIL |
| 5054 | 535416.40 | 3687903.67 | 4.74 | TOP RAIL\EDGE ROAD |
| 5055 | 535433.74 | 3687906.30 | 4.67 | TOP RAIL\CL ROAD |
| 5056 | 535447.20 | 3687908.58 | 4.67 | TOP RAIL\EDGE ROAD |
| 5057 | 535521.09 | 3687923.53 | 4.26 | TOP RAIL |
| 5058 | 535772.94 | 3687987.88 | 3.98 | TOP RAIL\EDGE ROAD |
| 5059 | 535787.88 | 3687991.72 | 3.89 | TOP RAIL\CL ROAD |
| 5060 | 535802.85 | 3687995.53 | 3.87 | TOP RAIL\EDGE ROAD |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 5061 | 535949.61 | 3688033.23 | 3.53 | TOP RAIL |
| 5062 | 536202.95 | 3688097.30 | 3.28 | TOP RAIL\EDGE ROAD |
| 5063 | 536227.81 | 3688103.71 | 3.20 | TOP RAIL\CL ROAD |
| 5064 | 536241.54 | 3688106.93 | 2.99 | TOP RAIL\EDGE ROAD |
| 5065 | 536269.47 | 3688114.15 | 3.25 | TOP RAIL\EDGE ROAD |
| 5066 | 542657.63 | 3685684.26 | 0.20 | TOP RAIL |
| 5067 | 542682.63 | 3685776.19 | 0.10 | TOP RAIL |
| 5068 | 542746.45 | 3685909.69 | -0.30 | TOP RAIL |
| 5069 | 542820.48 | 3686010.00 | -0.02 | TOP RAIL |
| 5070 | 542914.89 | 3686099.96 | 0.21 | TOP RAIL |
| 5071 | 542958.96 | 3686134.38 | 0.15 | TOP RAIL |
| 5072 | 543840.78 | 3686785.77 | 1.11 | TOP RAIL |
| 5073 | 544175.18 | 3687039.56 | 2.01 | TOP RAIL |
| 5074 | 544452.88 | 3687250.31 | 4.02 | TOP RAIL\E RR BRIBGE |
| 5075 | 544550.41 | 3687324.11 | 3.97 | TOP RAIL\E RR BRIBGE |
| 5076 | 542131.42 | 3689019.77 | 0.05 | TOP RAIL |
| 5077 | 542287.19 | 3689007.44 | 1.09 | TOP RAIL |
| 5078 | 542522.02 | 3688988.17 | 2.16 | TOP RAIL\EDGE ROAD |
| 5079 | 542540.76 | 3688986.50 | 2.41 | TOP RAIL\CL ROAD |
| 5080 | 542561.19 | 3688984.74 | 2.52 | TOP RAIL\EDGE ROAD |
| 5081 | 542504.43 | 3689209.21 | 2.40 | TOP RAIL\EDGE ROAD |
| 5082 | 542680.31 | 3689104.01 | 1.91 | TOP RAIL |
| 5083 | 542744.92 | 3689069.48 | 1.27 | TOP RAIL |
| 5084 | 542810.85 | 3689039.71 | 0.78 | TOP RAIL |
| 5085 | 542895.15 | 3689011.99 | 0.49 | TOP RAIL |
| 5086 | 542980.40 | 3688995.25 | 0.30 | TOP RAIL |
| 5087 | 542923.86 | 3688955.13 | 1.52 | TOP RAIL |
| 5088 | 542636.17 | 3688978.53 | 2.81 | TOP RAIL |
| 5089 | 542810.12 | 3688488.26 | -0.17 | TOP RAIL |
| 5090 | 542828.04 | 3688577.04 | 0.45 | TOP RAIL |
| 5091 | 542858.39 | 3688655.69 | 1.35 | TOP RAIL\EDGE ROAD |
| 5092 | 542867.98 | 3688674.47 | 1.69 | TOP RAIL\CL ROAD |
| 5093 | 542881.28 | 3688697.13 | 2.10 | TOP RAIL\EDGE ROAD |
| 5094 | 542945.28 | 3688777.22 | 3.41 | TOP RAIL |
| 5095 | 543012.71 | 3688834.01 | 3.79 | TOP RAIL |
| 5096 | 543113.63 | 3688887.67 | 2.77 | TOP RAIL |
| 5097 | 543200.59 | 3688912.04 | 1.84 | TOP RAIL |
| 5098 | 543319.82 | 3688922.54 | 0.90 | TOP RAIL |
| 5099 | 543779.22 | 3688884.78 | 0.94 | TOP RAIL |
| 5100 | 544256.57 | 3688845.82 | 1.18 | TOP RAIL |
| 5101 | 544756.85 | 3688805.16 | 1.58 | TOP RAIL |
| 5102 | 545580.20 | 3688738.43 | 3.87 | TOP RAIL |
| 5103 | 545930.92 | 3688709.88 | 4.51 | TOP RAIL |
| 5104 | 546302.21 | 3688680.18 | 4.93 | TOP RAIL |
| 5105 | 558994.44 | 3691060.04 | 6.60 | TOP RAIL\E FLOODGATE |
| 5106 | 558844.21 | 3690539.31 | 6.88 | TOP RAIL |
| 5107 | 558699.00 | 3690029.48 | 6.54 | TOP RAIL |
| 5108 | 558642.63 | 3689824.35 | 6.41 | TOP RAIL |
| 5109 | 558619.53 | 3689741.34 | 6.45 | TOP RAIL |
| 5110 | 558555.73 | 3689508.21 | 6.51 | TOP RAIL |
| 5111 | 558526.30 | 3689401.69 | 6.55 | TOP RAIL |
| 5112 | 558474.41 | 3689231.25 | 6.48 | TOP RAIL |

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 5113 | 558410.01 | 3689066.76 | 6.52 | TOP RAIL |
| 5114 | 558353.25 | 3688953.62 | 6.63 | TOP RAIL |
| 5115 | 558292.30 | 3688852.10 | 6.72 | TOP RAIL |
| 5116 | 558231.18 | 3688764.68 | 6.68 | TOP RAIL |
| 5117 | 558168.32 | 3688685.16 | 6.68 | TOP RAIL |
| 5118 | 558065.59 | 3688566.18 | 6.93 | TOP RAIL\E RR BRIBGE |
| 5119 | 557992.61 | 3688484.35 | 7.01 | TOP RAIL\E RR BRIBGE |
| 5120 | 557933.08 | 3688418.97 | 6.93 | TOP RAIL |
| 5121 | 557853.63 | 3688336.08 | 6.85 | TOP RAIL |
| 5122 | 557773.07 | 3688260.48 | 6.84 | TOP RAIL |
| 5123 | 557628.28 | 3688146.64 | 6.65 | TOP RAIL |
| 5124 | 557528.65 | 3688082.57 | 6.58 | TOP RAIL |
| 5125 | 557391.21 | 3688009.97 | 6.48 | TOP RAIL |
| 5126 | 557265.73 | 3687956.65 | 6.57 | TOP RAIL |
| 5127 | 557130.72 | 3687913.11 | 6.56 | TOP RAIL |
| 5128 | 556944.00 | 3687873.67 | 6.37 | TOP RAIL |
| 5129 | 556709.96 | 3687855.03 | 6.06 | TOP RAIL |
| 5130 | 556568.31 | 3687859.37 | 5.97 | TOP RAIL |
| 5131 | 556361.86 | 3687857.76 | 5.74 | TOP RAIL |
| 5152 | 537851.84 | 3653693.19 | 4.86 | TOP RAIL |
| 5153 | 537858.30 | 3653708.63 | 5.09 | TOP RAIL |
| 5154 | 537861.10 | 3653771.51 | 5.34 | TOP RAIL |
| 5155 | 537859.56 | 3653851.53 | 5.15 | TOP RAIL |
| 5156 | 537845.67 | 3654068.94 | 4.71 | TOP RAIL |
| 5157 | 537791.65 | 3654819.90 | 4.32 | TOP RAIL\EDGE ROAD |
| 5158 | 537789.64 | 3654849.12 | 4.18 | TOP RAIL\EDGE ROAD |
| 5159 | 537779.24 | 3655009.67 | 4.21 | TOP RAIL |
| 5160 | 537764.66 | 3655239.17 | 4.30 | TOP RAIL\EDGE ROAD |
| 5161 | 537763.16 | 3655261.37 | 4.38 | TOP RAIL\EDGE ROAD |
| 5162 | 537761.63 | 3655277.56 | 4.45 | TOP RAIL |
| 5163 | 537733.09 | 3655450.05 | 4.40 | TOP RAIL |
| 5164 | 537708.55 | 3655737.63 | 3.88 | TOP RAIL |
| 5165 | 537688.59 | 3655968.59 | 3.80 | TOP RAIL |

## Low Chord Elevations

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 115 | 544154.76 | 3680272.61 | 7.66 | LOW CORD |
| 132 | 543676.64 | 3681398.05 | 5.53 | LOW CORD |
| 141 | 543702.84 | 3681408.66 | 5.55 | LOW CORD |
| 219 | 542651.35 | 3688820.51 | -5.72 | LOW CORD |
| 260 | 544454.80 | 3687286.32 | -1.66 | LOW CORD |
| 277 | 542530.39 | 3689289.59 | -1.72 | LOW CORD |
| 299 | 542557.68 | 3689181.06 | -0.40 | LOW CORD |
| 313 | 542596.80 | 3689026.69 | -3.68 | LOW CORD |
| 332 | 546231.43 | 3688598.06 | -2.08 | LOW CORD |
| 369 | 548773.52 | 3688518.65 | 9.35 | LOW CORD |
| 395 | 558017.35 | 3688539.93 | -2.52 | LOW CORD |
| 418 | 537267.18 | 3663012.10 | 0.02 | LOW CORD |
| 419 | 537264.73 | 3663042.36 | -2.52 | LOW CORD |
| 420 | 537263.20 | 3663065.03 | 0.01 | LOW CORD |
| 467 | 537278.46 | 3662595.75 | 1.73 | LOW CORD |

## Culverts

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 234 | 545216.87 | 3687879.95 | -11.55 | INVERT-7.2FT.CORR. PIPE |
| 235 | 545258.34 | 3687824.55 | -12.04 | INVERT-7.2FT.CORR. PIPE |
| 396 | 548333.35 | 3688446.80 | -9.42 | INV-4FT ROUND CONC CULVERT |
| 397 | 547755.07 | 3688481.04 | -12.02 | INV-3FT ROUND CONC CULVERT |
| 398 | 547487.62 | 3688516.29 | -11.04 | INV-3FT ROUND CONC CULVERT |
| 399 | 546747.65 | 3688571.73 | -13.60 | INV-4FT ROUND CONC CULVERT |
| 400 | 546428.71 | 3688605.21 | -13.25 | INV-4.5FT ROUND CONC CULVERT |
| 401 | 542709.50 | 3688469.77 | -12.88 | INV-8FTX8FT CONC BOX CULVERT |
| 402 | 542647.10 | 3687790.31 | -15.11 | INV-3FTX3.7FT CONC BOX CULVERT |
| 403 | 542623.41 | 3687494.72 | -13.24 | INV-2.3FT CONC ROUND CULVERT |
| 404 | 542562.80 | 3686717.57 | -14.02 | INV-36" CONC ROUND CULVERT |
| 405 | 542513.31 | 3686015.78 | -15.80 | INV-5FTX8FT 1\2 MOON CONC CULVERT |
| 406 | 542513.72 | 3686000.02 | -13.11 | INV-3.3FTX4FT OVEL CONC CULVERT |
| 407 | 542480.29 | 3685645.12 | -14.26 | INV-3.4FT ROUND CONC CULVERT |
| 408 | 542401.73 | 3684645.70 | -11.18 | INV-24" ROUND CONC CULVERT |
| 409 | 542399.32 | 3684612.72 | -12.79 | INV-24" ROUND CONC CULVERT |
| 410 | 542442.49 | 3684434.78 | -13.02 | INV-24" ROUND CONC CULVERT |
| 411 | 542576.38 | 3684094.02 | -11.64 | INV-24" ROUND CONC CULVERT |
| 412 | 542735.50 | 3683690.78 | -11.81 | INV-2.3FT ROUND CONC CULVERT |
| 413 | 542881.50 | 3683321.45 | -11.79 | INV-24" ROUND CONC CULVERT |
| 414 | 543022.32 | 3682987.77 | -12.88 | INV-6FT ROUND CONC CULVERT |
| 5132 | 548606.50 | 3688432.30 | -10.13 | INV-4.1FT ROUND CONC CULVERT |
| 5133 | 546474.07 | 3688731.63 | -10.24 | INV-4.5FT ROUND CONC CULVERT |
| 5134 | 546205.73 | 3688627.90 | -13.04 | INV-3.5FT ROUND CONC CULVERT |
| 5135 | 545594.85 | 3688674.91 | -10.68 | INV-3FT ROUND CONC CULVERT |
| 5136 | 545123.16 | 3688715.20 | -13.93 | INV-3.5FT ROUND CONC CULVERT |
| 5137 | 544987.73 | 3688724.15 | -18.80 | INV-9FTX10FT ROUND CONC CULVERT |
| 5138 | 544017.87 | 3688806.34 | -13.46 | INV\3FT ROUND CONC CULVERT |
| 5139 | 542434.20 | 3689721.54 | -15.42 | INV\3FT ROUND CONC CULVERT |
| 5140 | 542291.87 | 3690296.08 | -16.03 | INV\3FT ROUND CONC CULVERT |
| 5141 | 542217.08 | 3690590.14 | -15.12 | INV\3FT ROUND CONC CULVERT |
| 5142 | 542159.28 | 3690826.30 | -14.91 | INV\3FT ROUND CONC CULVERT |
| 5143 | 542147.93 | 3690870.69 | -16.44 | INV\1.5FT ROUND CONC CULVERT |
| 5144 | 541920.20 | 3691786.22 | -12.48 | INV\6FTX8FT CONC BOX CULVERT |
| 5145 | 541709.50 | 3692763.12 | -10.65 | INV\1FT ROUND CONC CULVERT |
| 5146 | 541603.36 | 3693059.71 | -14.76 | INV\3.5FT ROUND CONC CULVERT |
| 5147 | 541529.31 | 3693407.23 | -10.37 | INV\4.5FTX7FT OVAL CONC CULVERT |
| 5148 | 541234.52 | 3694688.63 | -8.71 | INV\4.5FT ROUND CONC CULVERT |
| 5149 | 543470.86 | 3681826.13 | -11.68 | INV\2FT ROUND CONC CULVERT |
| 5150 | 543319.48 | 3682209.87 | -11.74 | INV\1.5FT ROUND CONC CULVERT |
| 5151 | 543168.30 | 3682593.43 | -11.86 | INV\1.5FT ROUND CONC CULVERT |

# CULVERTS

## All elevations are NAVD 88(2004.65) Feet.

396

| Northing | Easting | Elevation |
|---|---|---|
| 548333.35 | 3688446.80 | -9.42 |

INV-4FT ROUND CONC CULVERT

397

| Northing | Easting | Elevation |
|---|---|---|
| 547755.06 | 3688481.04 | -12.02 |

INV-3FT ROUND CONC CULVERT

398
Northing Easting Elevation
547487.62 3688516.28 -11.04

INV-3FT ROUND CONC CULVERT

399
Northing Easting Elevation
546747.64 3688571.73 -13.60

INV-4FT ROUND CONC CULVERT

400

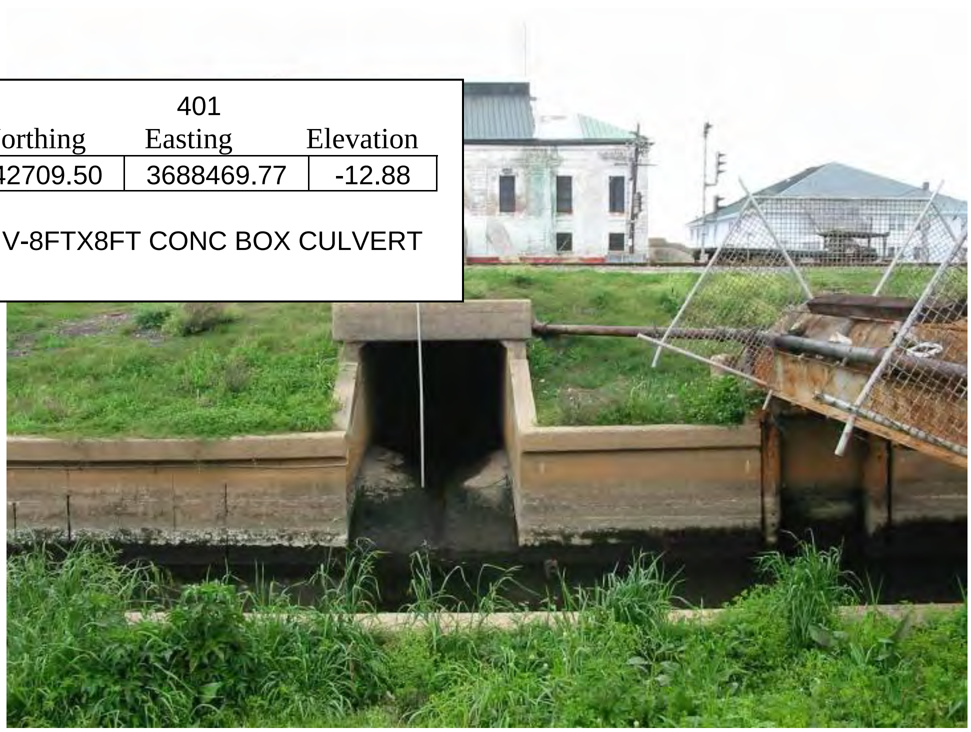
| Northing | Easting | Elevation |
|---|---|---|
| 546428.71 | 3688605.21 | -13.25 |

INV-4.5FT ROUND CONC CULVERT

401

| Northing | Easting | Elevation |
|---|---|---|
| 542709.50 | 3688469.77 | -12.88 |

INV-8FTX8FT CONC BOX CULVERT



402

| Northing | Easting | Elevation |
|---|---|---|
| 542647.10 | 3687790.31 | -15.11 |

INV-3FTX3.7FT CONC BOX CULVERT

403

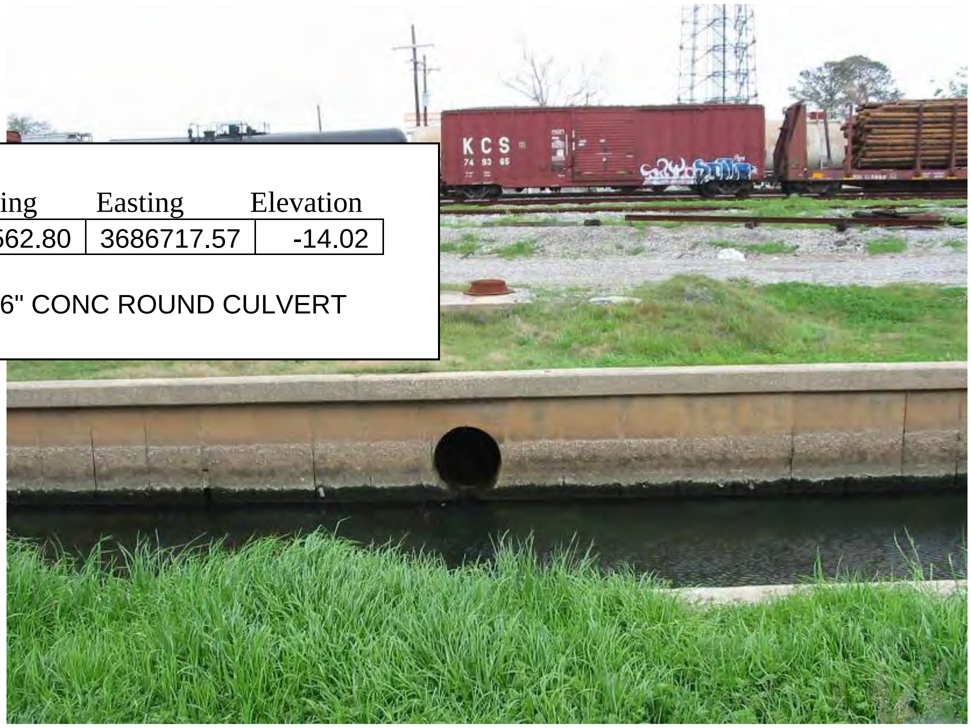
| Northing | Easting | Elevation |
|---|---|---|
| 542623.40 | 3687494.72 | -13.24 |

INV-2.3FT CONC ROUND CULVERT

404

| Northing | Easting | Elevation |
|---|---|---|
| 542562.80 | 3686717.57 | -14.02 |

INV-36" CONC ROUND CULVERT




405

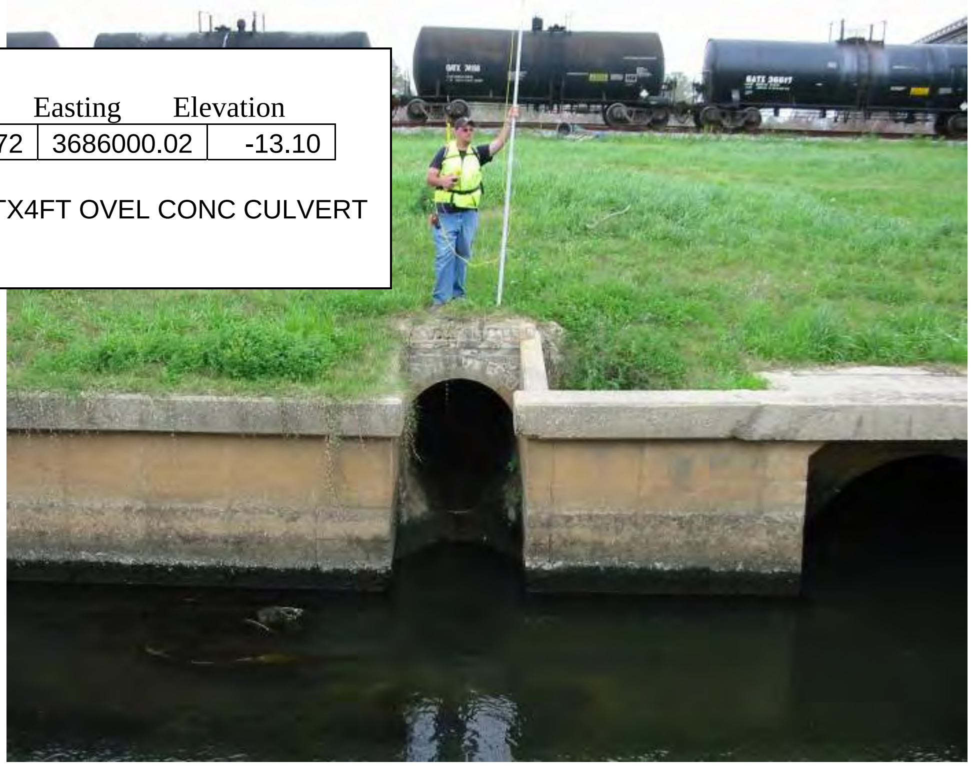
| Northing | Easting | Elevation |
|---|---|---|
| 542513.31 | 3686015.78 | -15.80 |

INV-5FTX8FT 1\2 MOON CONC

406

| Northing | Easting | Elevation |
| --- | --- | --- |
| 542513.72 | 3686000.02 | -13.10 |

INV-3.3FTX4FT OVEL CONC CULVERT



407

| Northing | Easting | Elevation |
| --- | --- | --- |
| 542480.29 | 3685645.12 | -14.26 |

INV-3.4FT ROUND CONC CULVERT

408

| Northing | Easting | Elevation |
|---|---|---|
| 542401.73 | 3684645.70 | -11.18 |

INV-24" ROUND CONC CULVERT

409

| Northing | Easting | Elevation |
|---|---|---|
| 542399.32 | 3684612.72 | -12.79 |

INV-24" ROUND CONC CULVERT

410

| Northing | Easting | Elevation |
| --- | --- | --- |
| 542442.48 | 3684434.78 | -13.02 |

INV-24" ROUND CONC CULVERT

411

| Northing | Easting | Elevation |
| --- | --- | --- |
| 542576.38 | 3684094.02 | -11.64 |

INV-24" ROUND CONC CULVERT

412

| Northing | Easting | Elevation |
|---|---|---|
| 542735.50 | 3683690.78 | -11.81 |

INV-2.3FT ROUND CONC CULVERT

413

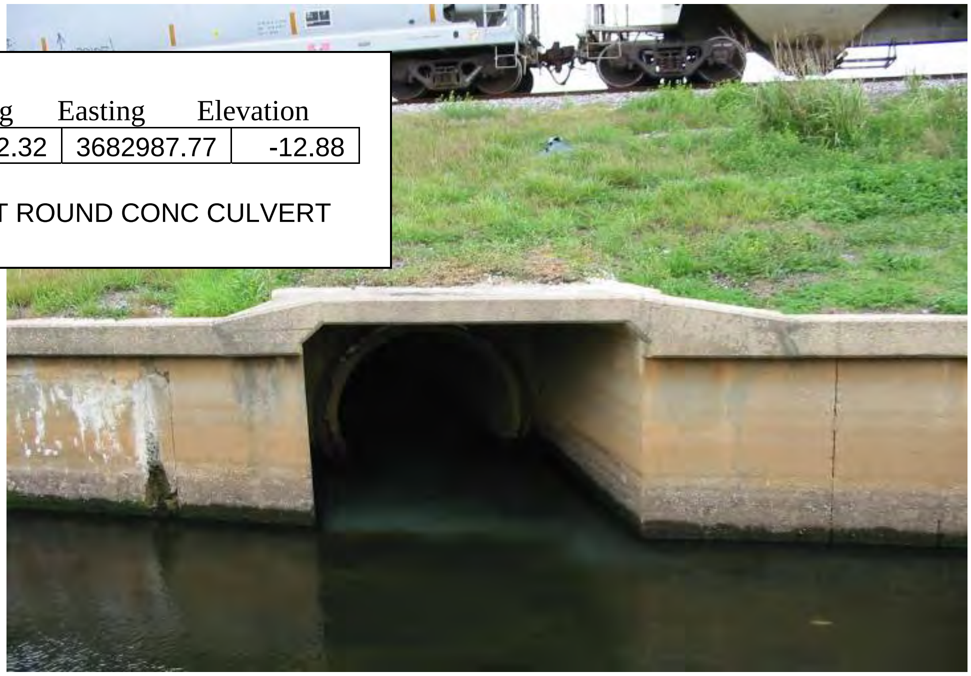
| Northing | Easting | Elevation |
|---|---|---|
| 542881.50 | 3683321.45 | -11.79 |

INV-24" ROUND CONC CULVERT

414

| Northing | Easting | Elevation |
|---|---|---|
| 543022.32 | 3682987.77 | -12.88 |

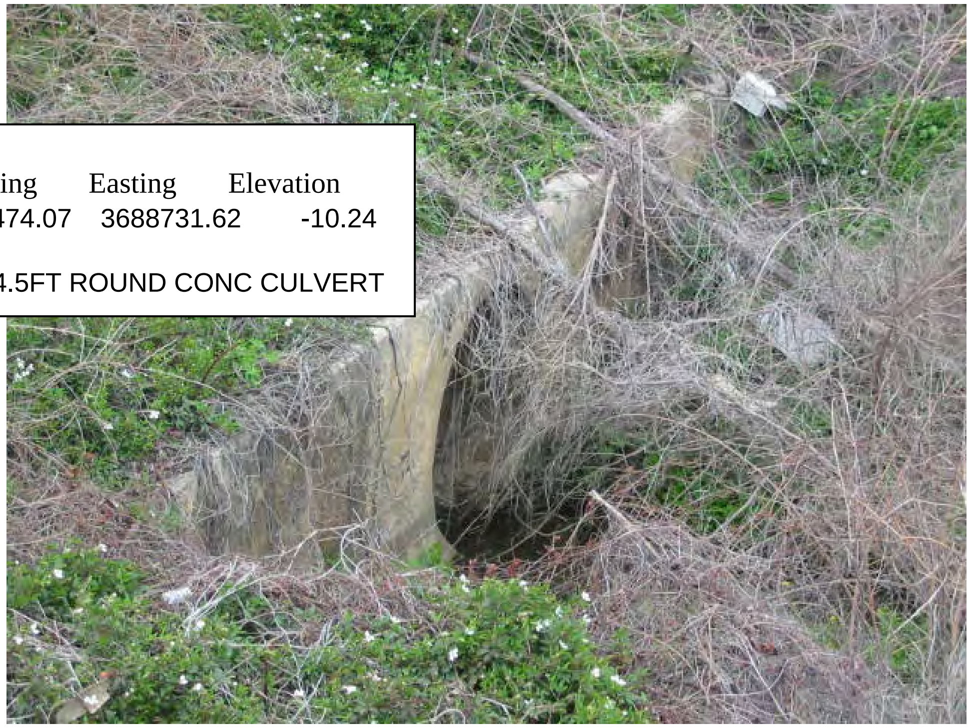
INV-6FT ROUND CONC CULVERT



5132

| Northing | Easting | Elevation |
|---|---|---|
| 548606.50 | 3688432.30 | -10.13 |

INV-4.1FT ROUND CONC CULVERT



5133
Northing Easting Elevation
546474.07 3688731.62 -10.24

INV-4.5FT ROUND CONC CULVERT

5134
Northing Easting Elevation
546205.73 3688627.90 -13.04

INV-3.5FT ROUND CONC CULVERT

5135

| Northing | Easting | Elevation |
|---|---|---|
| 545594.85 | 3688674.91 | -10.68 |

INV-3FT ROUND CONC CULVERT

5136

| Northing | Easting | Elevation |
|---|---|---|
| 545123.16 | 3688715.20 | -13.93 |

INV-3.5FT ROUND CONC CULVERT

5137
Northing Easting Elevation
544987.73 3688724.15 -18.80

INV-9FTX10FT ROUND CONC CULVERT

5138
Northing Easting Elevation
544017.87 3688806.34 -13.46

INV\3FT ROUND CONC CULVERT

5139

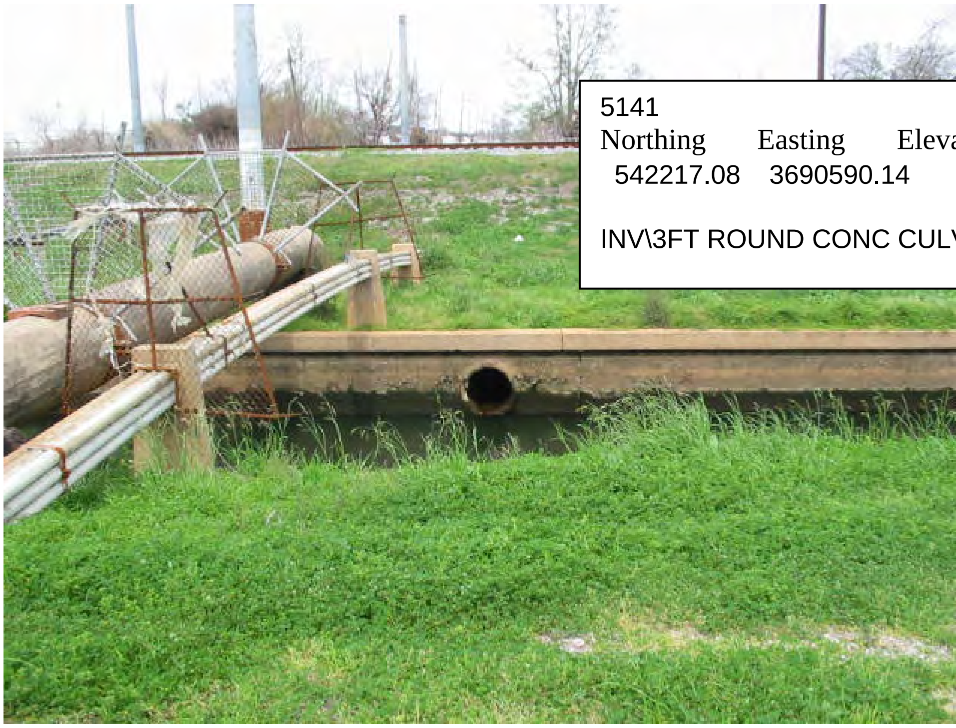
| Northing | Easting | Elevation |
|---|---|---|
| 542434.20 | 3689721.54 | -15.42 |

INV\3FT ROUND CONC CULVERT

5140

| Northing | Easting | Elevation |
|---|---|---|
| 542291.87 | 3690296.08 | -16.03 |

INV\3FT ROUND CONC CULVERT



5141
Northing Easting Elevation
542217.08 3690590.14 -15.12

INV\3FT ROUND CONC CULVERT

5142
Northing Easting Elevation
542159.28 3690826.30 -14.91

INV\3FT ROUND CONC CULVERT

5143
Northing Easting Elevation
542147.93 3690870.69 -16.44

INV\1.5FT ROUND CONC CULVERT

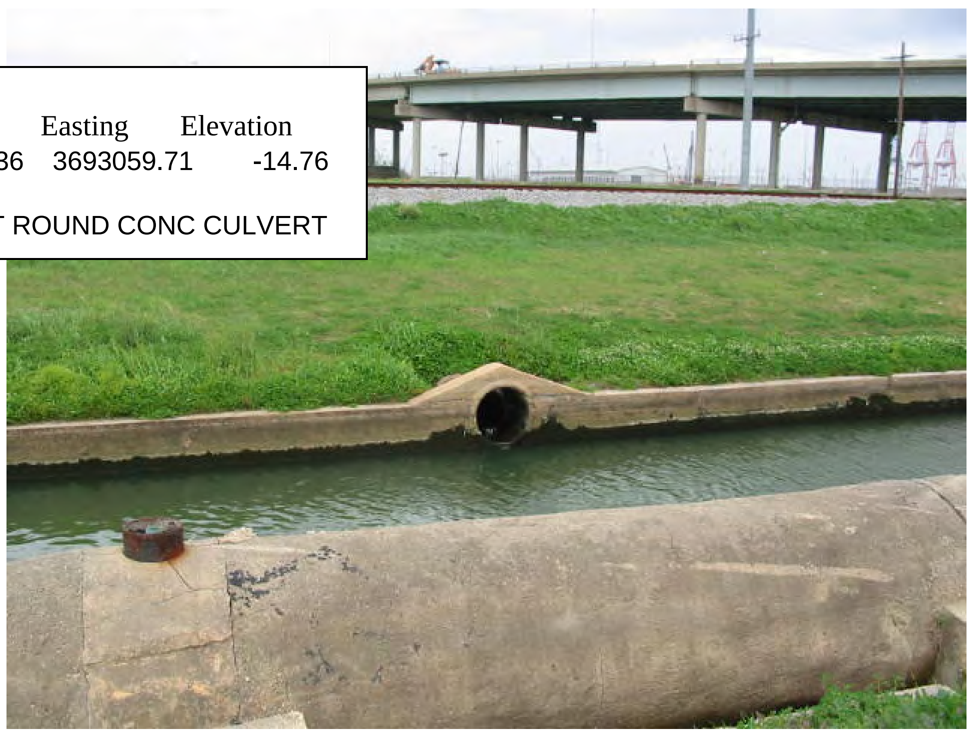
5144
Northing Easting Elevation
541920.20 3691786.22 -12.48

INV\6FTX8FT CONC BOX CULVERT

5145

| Northing | Easting | Elevation |
|---|---|---|
| 541709.50 | 3692763.12 | -10.65 |

INV\1FT ROUND CONC CULVERT



5146

| Northing | Easting | Elevation |
|---|---|---|
| 541603.36 | 3693059.71 | -14.76 |

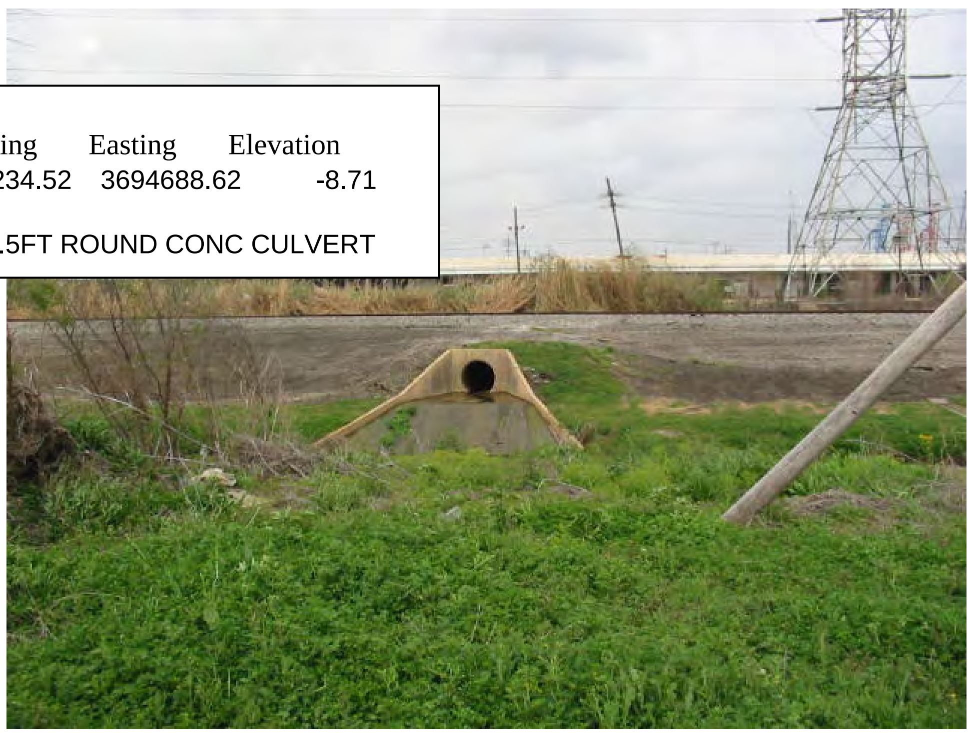
INV\3.5FT ROUND CONC CULVERT

5147
Northing Easting Elevation
541529.31 3693407.23 -10.37

INV\4.5FTX7FT OVAL CONC CULVERT

5148
Northing Easting Elevation
541234.52 3694688.62 -8.71

INV\4.5FT ROUND CONC CULVERT





This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.

5149

| Northing | Easting | Elevation |
|---|---|---|
| 543470.86 | 3681826.12 | -11.68 |

INV\2FT ROUND CONC CULVERT

5150

| Northing | Easting | Elevation |
|---|---|---|
| 543319.48 | 3682209.86 | -11.74 |

INV\1.5FT ROUND CONC CULVERT

5151

| Northing | Easting | Elevation |
|---|---|---|
| 543168.30 | 3682593.43 | -11.86 |

INV\1.5FT ROUND CONC CULVERT

# Appendix 6
# 17th Street Canal – Low Chord Elevations

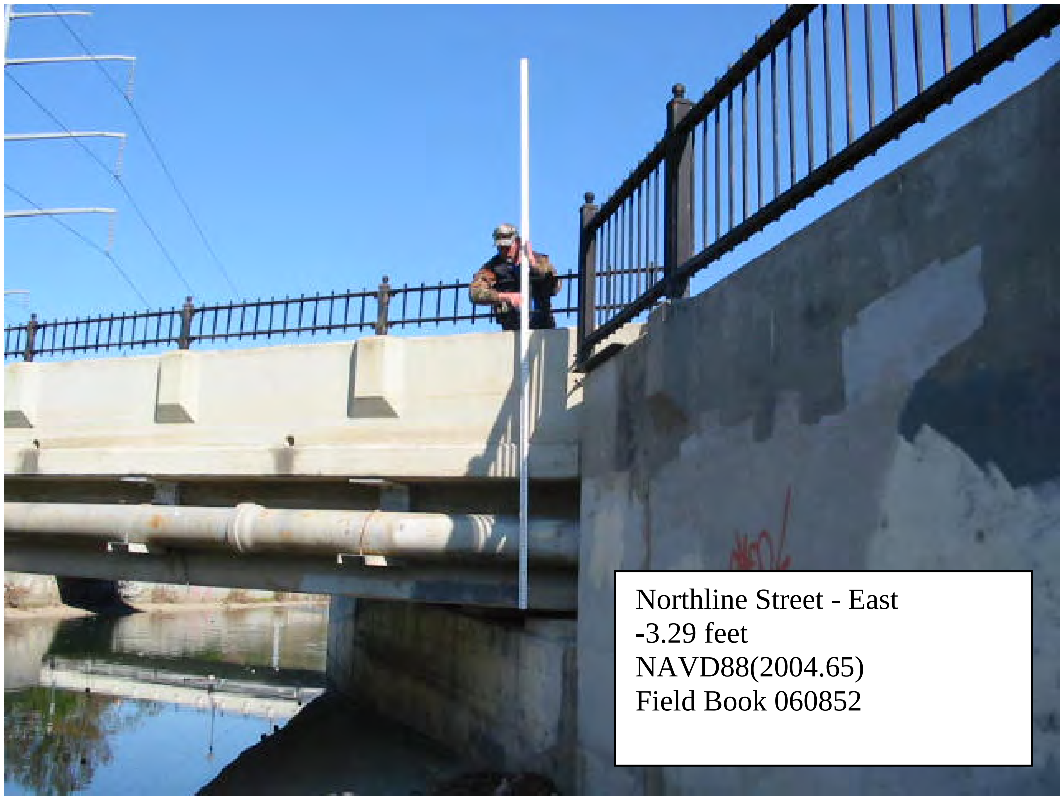

Veterans Hwy – West
7.36 feet
NAVD88(2004.65)
Field Book 060854


Veterans Hwy - East
7.40 feet
NAVD88(2004.65)
Field Book 060854

Hammond Hwy - West
3.93 feet
NAVD88(2004.65)
Field Book 060854

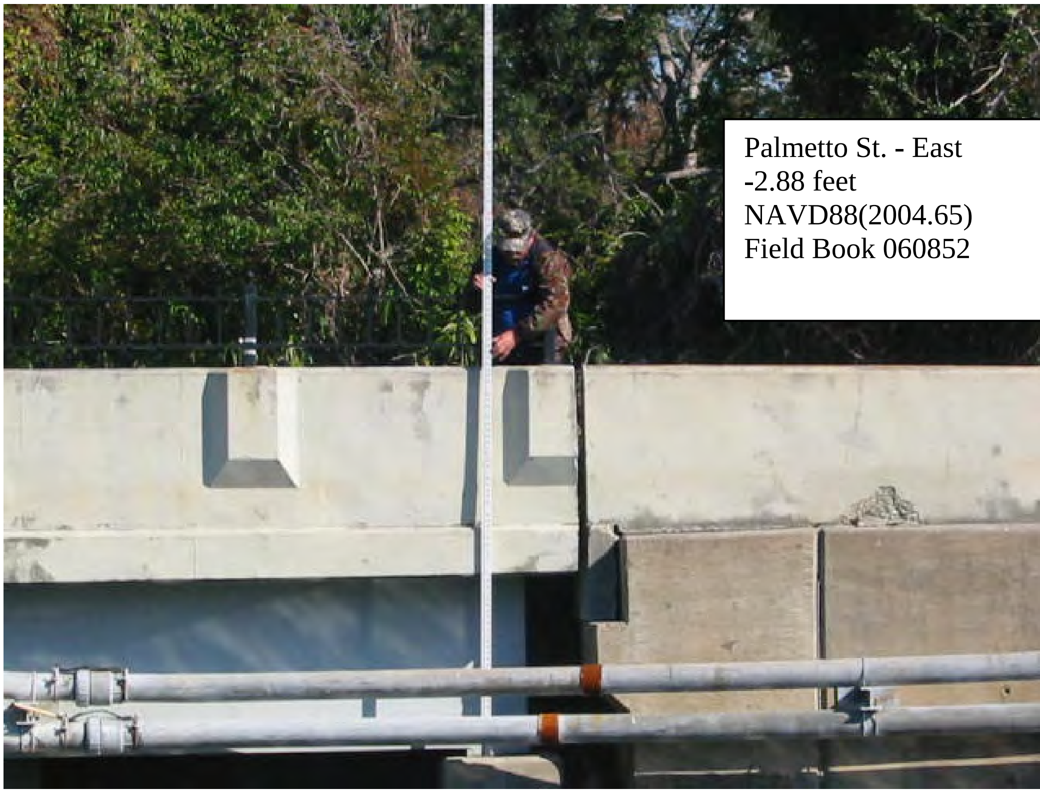
Hammond Hwy - East
4.94 feet
NAVD88(2004.65)
Field Book 060854

Northline Street - West
-3.72 feet
NAVD88(2004.65)
Field Book 060852



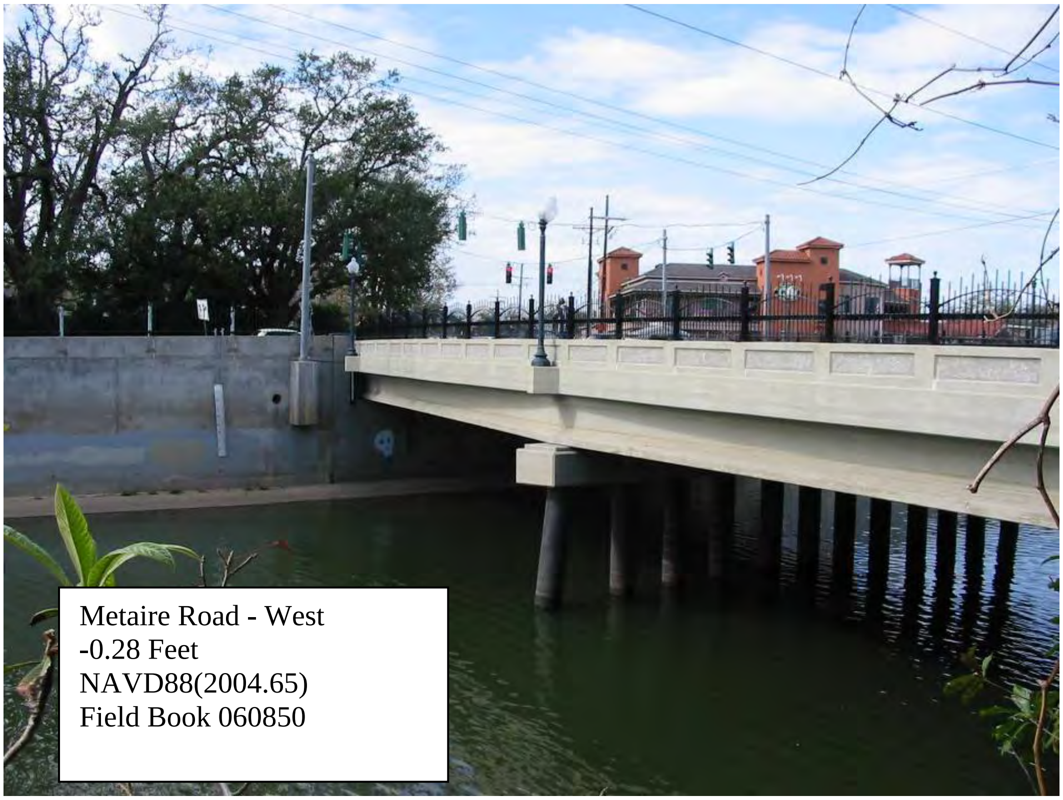
Northline Street - East
-3.29 feet
NAVD88(2004.65)
Field Book 060852


Palmetto St. - West
-1.84 feet
NAVD88(2004.65)
Field Book 060852



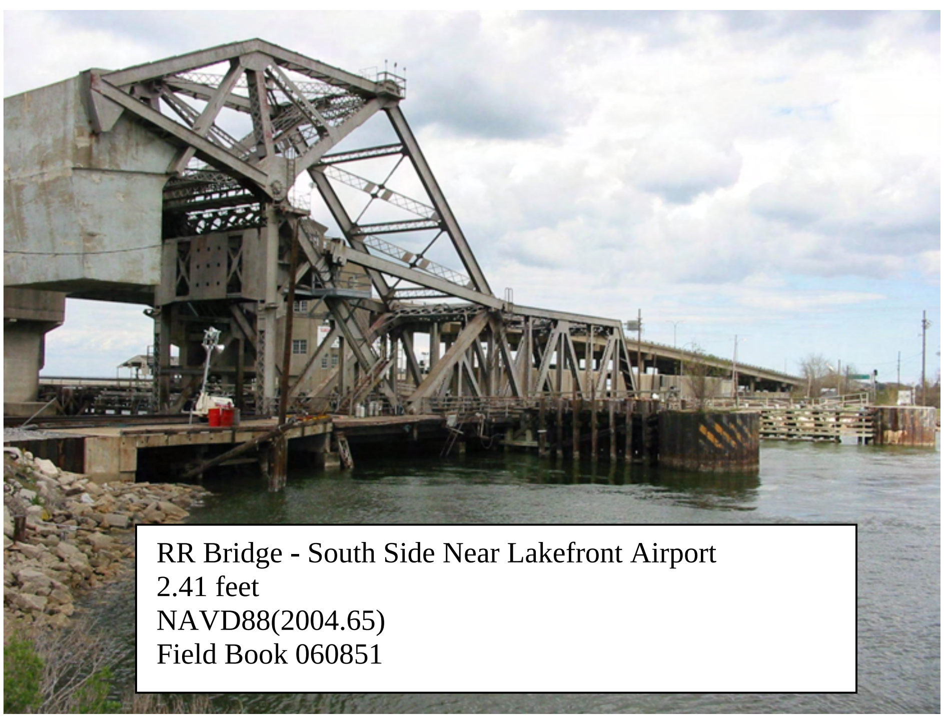
Palmetto St. - East
-2.88 feet
NAVD88(2004.65)
Field Book 060852

Metaire Road – East
-0.12 Feet
NAVD88(2004.65)
Field Book 060850


Metaire Road - West
-0.28 Feet
NAVD88(2004.65)
Field Book 060850

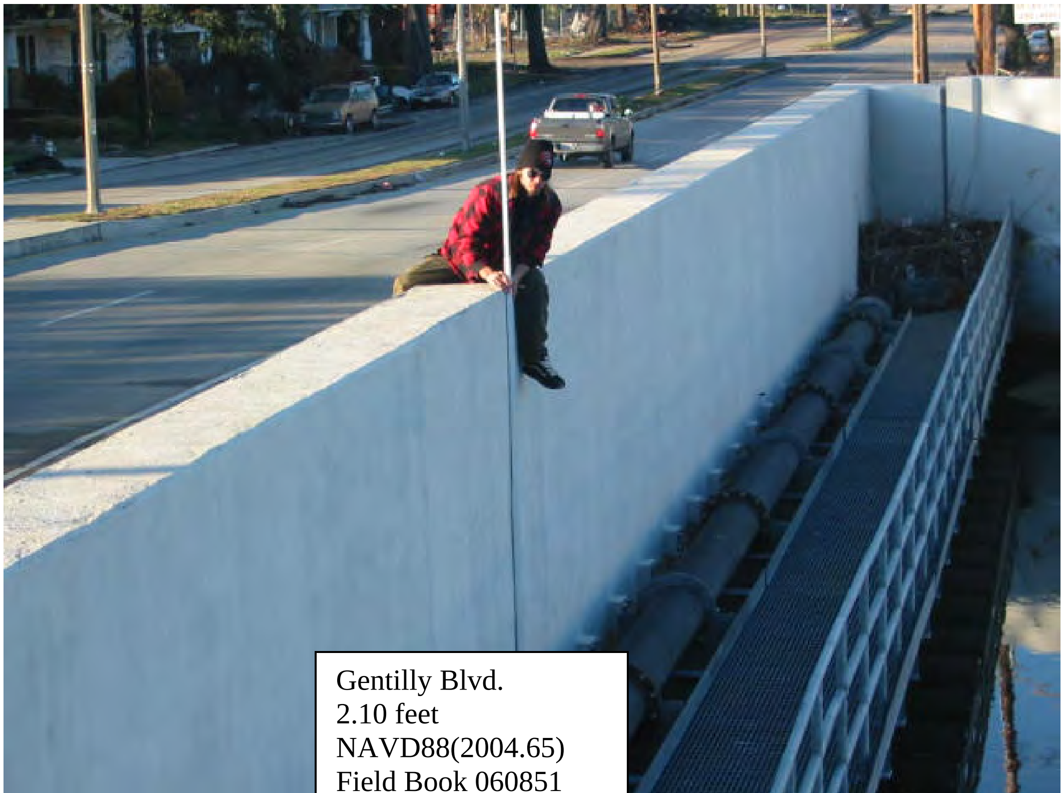
# Appendix 7
# Inner Harbor Navigation Canal – Low Chord Elevations


Florida Ave.
4.14 feet
NAVD88(2004.65)
Field Book 060858

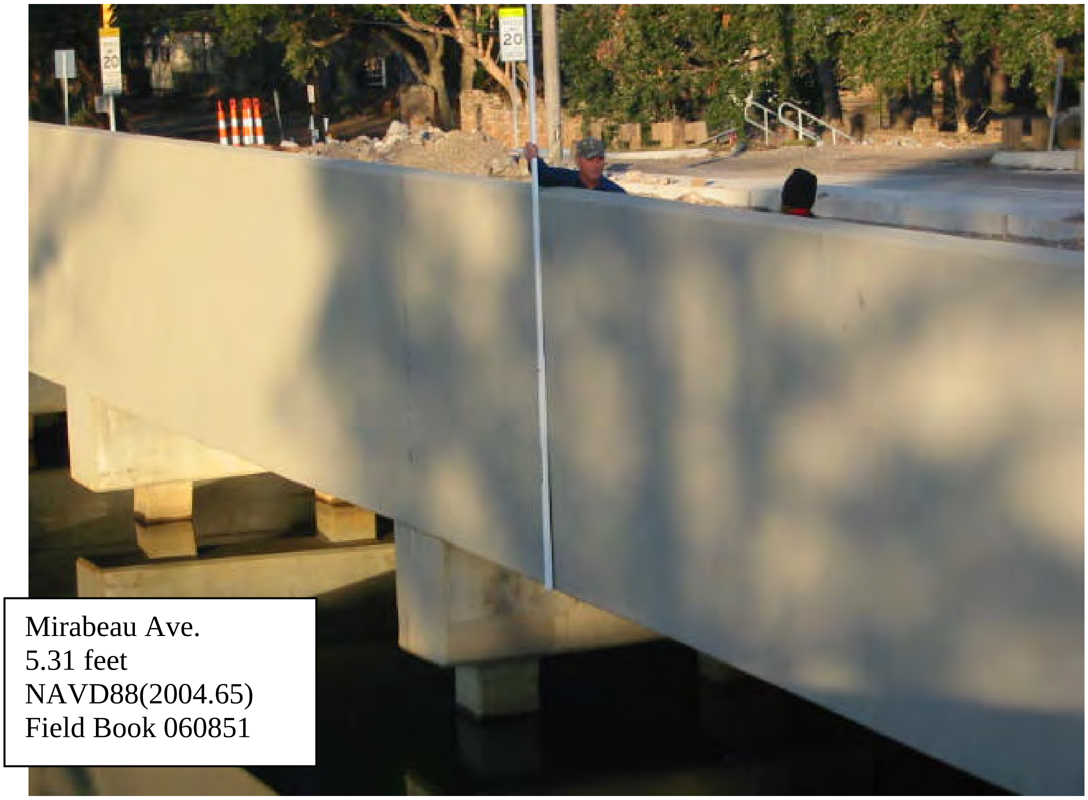

RR Bridge - South Side Near Lakefront Airport
2.41 feet
NAVD88(2004.65)
Field Book 060851

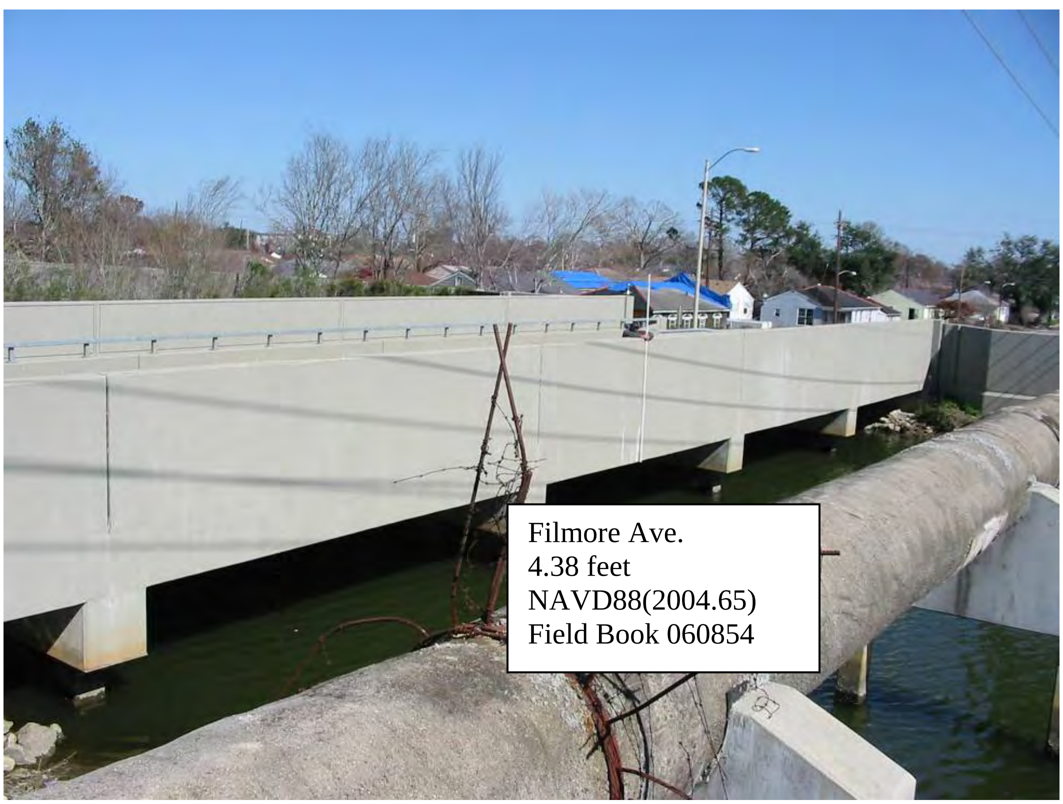
# Appendix 8
# London Avenue Canal – Low Chord Elevations


Railroad Bridge
5.77 feet
NAVD88(2004.65)
Field Book 060851



Gentilly Blvd.
2.10 feet
NAVD88(2004.65)
Field Book 060851

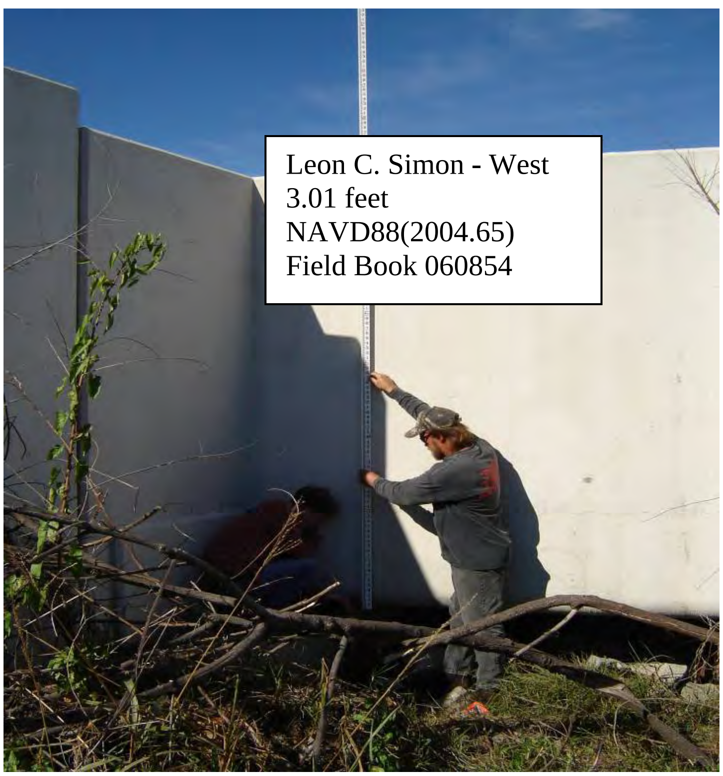

Mirabeau Ave.
5.31 feet
NAVD88(2004.65)
Field Book 060851


Filmore Ave.
4.38 feet
NAVD88(2004.65)
Field Book 060854

Robert E. Lee Blvd. - West
3.32 feet
NAVD88(2004.65)
Field Book 060854

Robert E. Lee Blvd. - East
2.74 feet
NAVD88(2004.65)
Field Book 060854

Leon C. Simon - East
3.46 feet
NAVD88(2004.65)
Field Book 060854

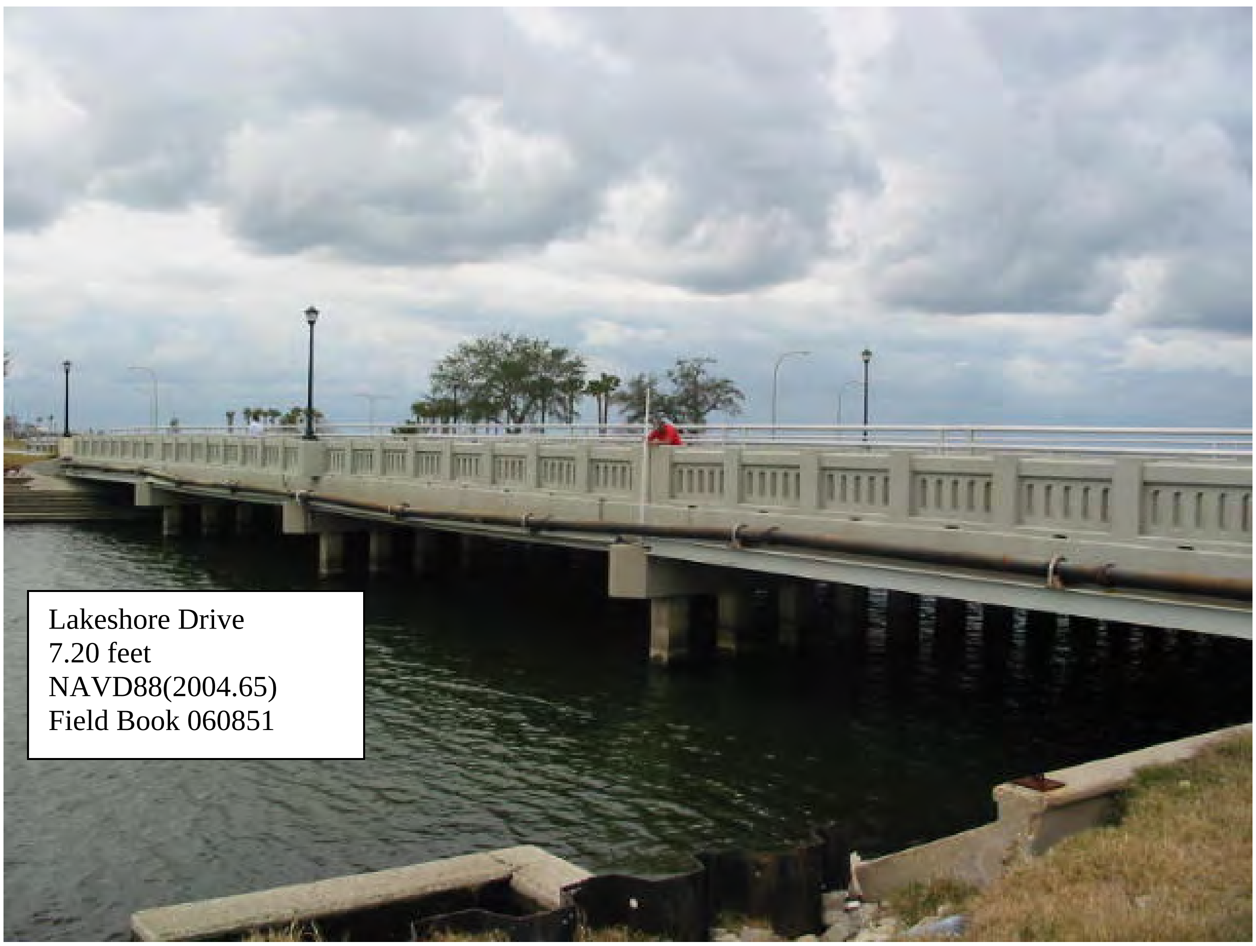


Leon C. Simon - West
3.01 feet
NAVD88(2004.65)
Field Book 060854

Lakeshore Drive - West
7.02 feet
NAVD88(2004.65)
Field Book 060854

Lakeshore Drive - East
7.03 feet
NAVD88(2004.65)
Field Book 060854

# Appendix 9
# Orleans Avenue Canal – Low Chord Elevations



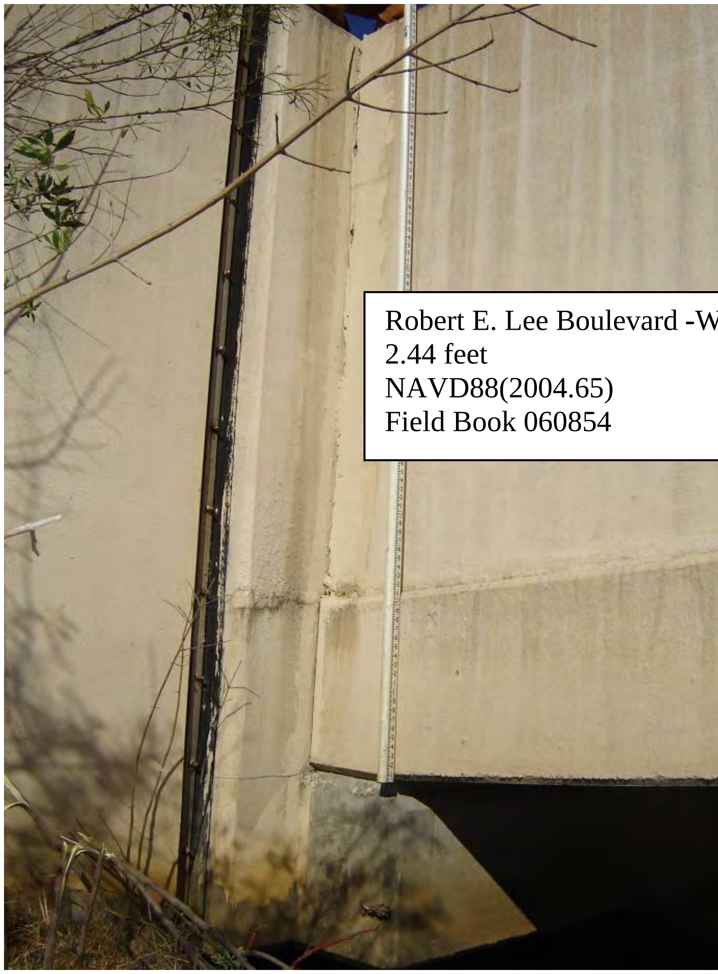
Harrison Avenue - East
4.52 feet
NAVD88(2004.65)
Field Book 060854

Harrison Avenue - West
4.26 feet
NAVD88(2004.65)
Field Book 060854

Filmore Avenue - East
2.20 feet
NAVD88(2004.65)
Field Book 060854

Filmore Avenue - West
3.40 feet
NAVD88(2004.65)
Field Book 060854

Robert E. Lee Boulevard - East
2.75 feet
NAVD88(2004.65)
Field Book 060854


Robert E. Lee Boulevard -West
2.44 feet
NAVD88(2004.65)
Field Book 060854

# Appendix 10
# High Water Marks – Orleans Parish, Interior


2930 Florida Ave. Elevation at slap = -3.59' NAVD88(2004.65)
Book# 060851, Pg. 8

5438 St Ferdinand Dr. slab = -5.90' NAVD88(2004.65)
Bk.060851, Pg 4

5544 St Ferdinand Dr.- Red Arrow on siding = 2.19’ NAVD88(2004.65)
Bk. 060851, Pg. 3


6422 Peoples Dr. – Porch near door = -3.12’ NAVD88(2004.65)
Bk. 060851, Pg. 2

Corner Of Peoples and Edge - Top Step at front door = -3.87’ NAVD88(2004.65)
Bk. 060851, Pg. 6

HWM OP-03 & London RR Gate – Survey arrow = 10.04’ NAVD88(2004.65)
Bk. 060851, Pg. 19

OP-06 = 13.39' NAVD88(2004.65)
Bk. 060850, Pg. 32

# Appendix 11
# High Water Marks Inner Harbor Navigation Canal, West Bank

DASM 01 High Water Mark IHNCWEST 14.20 feet NAVD88(2004.65)
Field Book 060858

DASM 02 High Water Mark IHNCWEST 14.17 feet NAVD88(2004.65)
Field book 060858

DASM 03 High Water Mark IHNCWEST 14.28 feet NAVD88(2004.65)
Field Book 060858

DASM 04 High Water Mark IHNCWEST 12.25 feet NAVD88(2004.65)
Field Book 060858

DASM 05 High Water Mark IHNCWEST 14.19 feet NAVD88(2004.65)
Field Book 060858


DASM 06 High Water Mark IHNCWEST 14.34 feet NAVD88(2004.65)
Field Book 060858


DASM 07 High Water Mark IHNCWEST 10.37 feet NAVD88(2004.65)
Field Book 060858


DASM 08 High Water Mark IHNCWEST 15.42 feet NAVD88(2004.65)
Field Book 060858


DASM 09 High Water Mark IHNCWEST 14.32 feet NAVD88(2004.65)
Field Book 060858

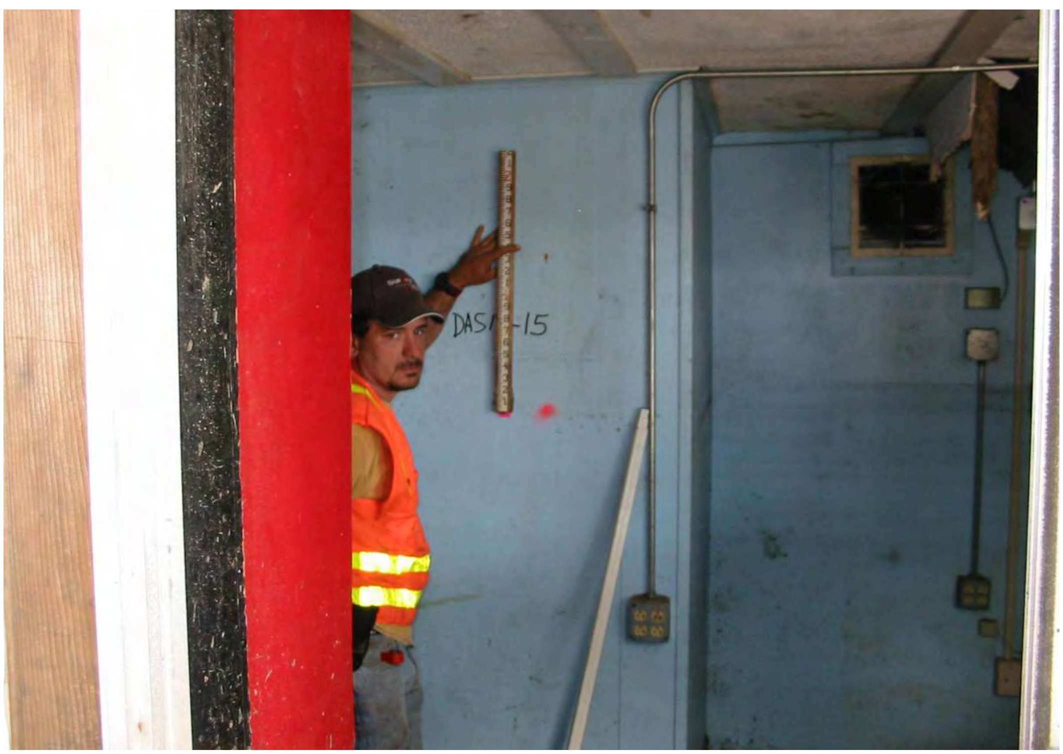
DASM 10 High Water Mark IHNCWEST 14.27 feet NAVD88(2004.65)
Field Book 060858

DASM 11 High Water Mark IHNCWEST 14.05 feet NAVD88(2004.65)
Field Book 060858


DASM 12 High Water Mark IHNCWEST 14.10 feet NAVD88(2004.65)
Field Book 060858

DASM 13 High Water Mark IHNCWEST 12.67 feet NAVD88(2004.65)
Field Book 060858


DASM 14 High Water Mark IHNCWEST 9.40 feet NAVD88(2004.65)
Field Book 060858



DASM 15 High Water Mark IHNCWEST 9.74 Feet NAVD88(2004.65)
Field Book 060858

# Appendix 12
# High Water Marks, Lower Plaquemines Parish

| | NAVD 88(2004.65) | Reference | |
|---|---|---|---|
| Location | Elevation | Book | Page |
| LA 110 Lower Plaquimines HWM | 12.17 | 60858 | 4 |
| LA 111 Lower Plaquimines HWM | -0.54 | 60858 | 5 |
| LA 112 Lower Plaquimines HWM | 7.01 | 60858 | 6 |
| LA 113 Lower Plaquimines HWM | 6.92 | 60858 | 7 |
| LA 114 Lower Plaquimines HWM | 7.56 | 60858 | 8 |
| LA 115 Lower Plaquimines HWM | 12.10 | 60858 | 9 |
| LA 116 Lower Plaquimines HWM | 13.87 | 60858 | 10 |
| LA 117 Lower Plaquimines HWM | 13.93 | 60858 | 11 |
| LA 118 Lower Plaquimines HWM | 14.06 | 60858 | 12 |
| LA 119 Lower Plaquimines HWM | 15.48 | 60858 | 13 |
| LA 120 Lower Plaquimines HWM | 16.23 | 60858 | 14 |
| LA 121 Lower Plaquimines HWM Bottom | 14.81 | 60858 | 15 |
| LA 121 Lower Plaquimines HWM Top | 15.35 | 60858 | 15 |

**LA 110= 12.17' NAVD88(2004.65)**

**LA 111 = -0.54' NAVD88(2004.65)**

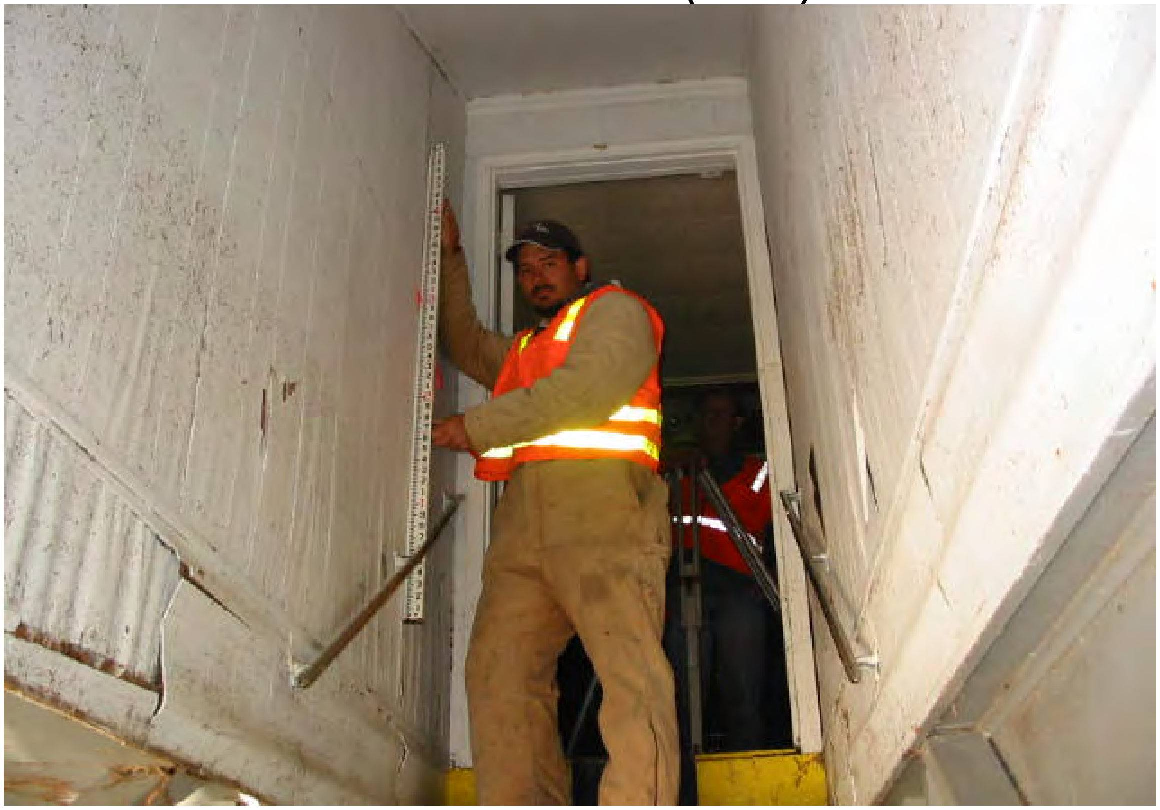
= THE FLOOR IN THE ROOM THAT HAD THE HWM MARKED ON THE WALL. DUE TO THE GUTTING OF THE INSIDE OF THE BUILDING THE HWM WAS GONE. SO WE JUST SHOT THE FLOOR NEAR THE LOCATION OF THE HWM.

**LA 112 = 7.01' NAVD88(2004.65)**

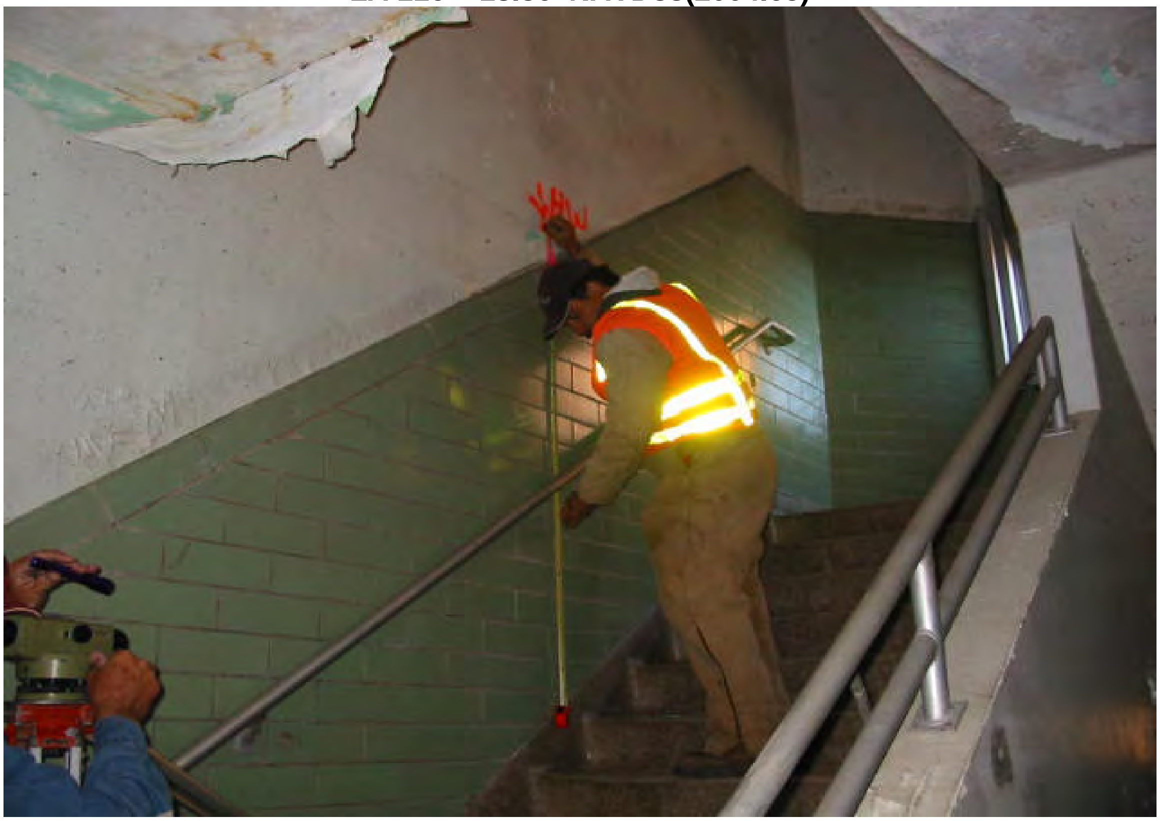

**LA 113 = 6.92' NAVD88(2004.65)**

**LA 114 = 7.56' NAVD88(2004.65)**

**LA 115 = 12.10' NAVD88(2004.65)**



**LA 116 = 13.86' NAVD88(2004.65)**



**LA 117 = 13.92' NAVD 88(2004.65)**

**LA 118 = 14.06’ NAVD88(2004.65)**

**LA 119 = 15.48’ NAVD88(2004.65)**

**LA 120 = 16.23' NAVD88(2004.65)**

**LA 121 = 14.81' AND 15.35' NAVD88(2004.65)** -- THERE WAS A LARGE PAINTED MARK ON THE STEEL BEAM. THESE 2 ELEV'S REPRESENT THE TOP AND THE BOTTOM OF THE PAINT MARK.

# Appendix 13
# High Water Mark, St. Bernard Parish

EBI Building HWM Elevation = 11.01' NAVD88(2004.65) Bk. 060855, Pg. 2

## St. Bernard Parrish Levee

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elevation | Location |
|---|---|---|---|---|
| **EBI building** | | | **11.01** | |
| 5-01C\L | 496736.70 | 3733434.95 | 15.32 | C\L LEVEE |
| 5-01N | 496765.33 | 3733452.20 | 9.05 | HWM-NORTHSIDE |
| 5-02S | 496709.26 | 3733420.41 | 10.67 | HWM-SOUTHSIDE |
| 5-03C\L | 495284.94 | 3734011.64 | 13.75 | C\L LEVEE |
| 5-03N | 495336.23 | 3734012.25 | 10.39 | HWM-NORTHSIDE |
| 5-04S | 495253.53 | 3734008.39 | 10.43 | HWM-SOUTHSIDE |
| 5-05C\L | 495278.29 | 3735995.25 | 14.10 | C\L LEVEE |
| 5-05N | 495294.24 | 3736010.68 | 11.51 | HWM-NORTHSIDE |
| 5-06S | 495254.66 | 3735967.82 | 10.48 | HWM-SOUTHSIDE |
| 5-07C\L | 495310.92 | 3738493.52 | 17.66 | C\L LEVEE |
| 5-07N | 495334.91 | 3738491.17 | 13.45 | HWM-NORTHSIDE |
| 5-08S | 495283.08 | 3738496.72 | 11.87 | SOUTHSIDE |
| 5-09C\L | 495324.63 | 3739645.54 | 16.61 | C\L LEVEE |
| 5-09N | 495344.15 | 3739645.93 | 12.96 | NORTHSIDE |
| 5-10S | 495299.74 | 3739644.76 | 11.80 | SOUTHSIDE |
| 5-11C\L | 495390.87 | 3744324.49 | 18.41 | C\L LEVEE |
| 5-11N | 495404.09 | 3744334.60 | 15.93 | NORTHSIDE |
| 5-12S | 495360.09 | 3744303.93 | 12.04 | SOUTHSIDE |
| 5-13C\L | 495451.10 | 3749110.19 | 17.17 | C\L LEVEE |
| 5-13N | 495466.33 | 3749116.01 | 14.82 | CHK |
| 5-14S | 495417.86 | 3749099.13 | 10.59 | SOUTHSIDE |
| 5-16C\L | 495529.96 | 3754902.12 | 14.32 | C\L LEVEE |
| 5-16N | 495546.13 | 3754899.90 | 10.94 | NORTHSIDE |
| 5-17S | 495514.96 | 3754904.76 | 11.71 | SOUTHSIDE |
| 5-18C\L | 495579.15 | 3758820.85 | 14.41 | C\L LEVEE |
| 5-18S | 495569.64 | 3758820.98 | 12.91 | SOUTHSIDE |
| 5-19C\L | 495608.13 | 3761064.70 | 14.62 | C\L LEVEE |
| 5-19S | 495601.27 | 3761064.92 | 13.66 | SOUTHSIDE |
| 5-20C\L | 495773.17 | 3771821.04 | 16.45 | C\L LEVEE |
| 5-20N | 495796.00 | 3771815.92 | 11.96 | NORTSIDE |
| 5-21C\L | 496221.10 | 3773239.07 | 17.45 | C\L LEVEE |
| 5-21N | 496251.95 | 3773233.33 | 11.73 | NORTHSIDE |
| 5-22S | 496196.31 | 3773245.72 | 12.26 | SOUTHSIDE |
| GPLDA 1 | 498770.75 | 3732248.72 | 19.16 | CHK |
| GPS TSPO | 497791.90 | 3774665.51 | 16.38 | CHK-COE GPS MARK |
| L 278 | 503313.63 | 3736367.04 | 6.93 | RTK BASE |
| REGGIO2 | 492424.58 | 3779917.84 | 4.99 | RTK BASE |
| STMY | 495846.54 | 3768426.83 | 6.82 | RTK BASE |

# Appendix 14
# Inner Harbor Navigation Canal West/SeaLand-Maresk Topographic Detail

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**See electronic data collector file "IHNCWEST.dc" for raw data.**

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 372 | 547912.92 | 3694882.23 | 14.62 | DIRT RIP RAP PILE |
| 373 | 547918.22 | 3694881.15 | 18.69 | DIRT RIP RAP PILE |
| 374 | 547922.98 | 3694880.50 | 18.18 | DIRT RIP RAP PILE |
| 375 | 547916.53 | 3694843.71 | 18.50 | DIRT RIP RAP PILE |
| 376 | 547916.11 | 3694819.96 | 17.59 | DIRT RIP RAP PILE |
| 377 | 547906.12 | 3694781.18 | 17.62 | DIRT RIP RAP PILE |
| 378 | 547881.41 | 3694730.86 | 17.68 | DIRT RIP RAP PILE |
| 379 | 547874.38 | 3694714.40 | 18.64 | DIRT RIP RAP PILE |
| 380 | 547869.17 | 3694706.86 | 15.60 | DIRT RIP RAP PILE |
| 381 | 547862.71 | 3694701.07 | 11.34 | DIRT RIP RAP PILE |
| 382 | 547857.15 | 3694698.83 | 8.00 | DIRT RIP RAP PILE |
| 383 | 547854.62 | 3694697.69 | 7.30 | TOP CONC BAG |
| 384 | 547811.33 | 3694674.30 | 7.54 | TOP CONC BAG |
| 385 | 547787.60 | 3694661.42 | 7.29 | TOP CONC BAG |
| 386 | 547727.40 | 3694627.69 | 7.50 | TOP CONC BAG |
| 387 | 547639.58 | 3694579.90 | 7.42 | TOP CONC BAG |
| 388 | 547547.64 | 3694529.01 | 7.30 | TOP CONC BAG |
| 389 | 547466.74 | 3694484.47 | 6.99 | TOP CONC BAG |
| 390 | 547382.75 | 3694439.24 | 6.69 | TOP CONC BAG |
| 391 | 547278.71 | 3694381.37 | 6.91 | TOP CONC BAG |
| 392 | 547210.08 | 3694343.50 | 6.97 | TOP CONC BAG |
| 393 | 547204.63 | 3694353.61 | 6.62 | TOP CONC BAG |
| 394 | 547203.86 | 3694355.43 | 6.29 | TOP CONC BAG |
| 395 | 547203.58 | 3694356.13 | 4.98 | EDGE ASPHALT ROAD |
| 396 | 547191.63 | 3694376.03 | 5.09 | EDGE ASPHALT ROAD |
| 397 | 547190.84 | 3694377.79 | 7.07 | TOP CONC BAG |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 398 | 547145.25 | 3694464.48 | 7.79 | TOP CONC BAG |
| 399 | 547124.63 | 3694501.30 | 8.04 | TOP CONC BAG |
| 400 | 547082.21 | 3694575.68 | 7.38 | TOP CONC BAG |
| 401 | 547055.48 | 3694625.01 | 7.01 | TOP CONC BAG |
| 402 | 547052.03 | 3694632.83 | 6.69 | TOP CONC BAG |
| 403 | 547050.86 | 3694634.28 | 6.74 | DIRT RIP RAP PILE |
| 404 | 547050.94 | 3694642.03 | 6.88 | DIRT RIP RAP PILE |
| 405 | 547068.92 | 3694652.52 | 7.15 | DIRT RIP RAP PILE |
| 406 | 547070.59 | 3694653.25 | 7.23 | TOP CONC BAG |
| 407 | 547153.38 | 3694696.23 | 7.20 | TOP CONC BAG |
| 408 | 547167.70 | 3694702.58 | 6.57 | TOP CONC BAG |
| 409 | 547166.85 | 3694701.30 | 7.33 | TOP SHEETPILING |
| 410 | 547261.61 | 3694759.07 | 7.92 | TOP SHEETPILING |
| 411 | 547328.64 | 3694794.28 | 7.96 | TOP SHEETPILING |
| 412 | 547384.35 | 3694821.70 | 7.74 | TOP SHEETPILING |
| 413 | 547476.70 | 3694865.95 | 7.55 | TOP SHEETPILING |
| 414 | 547546.28 | 3694898.47 | 7.65 | TOP SHEETPILING |
| 415 | 547557.28 | 3694879.44 | 7.54 | TOP SHEETPILING |
| 416 | 547576.18 | 3694888.93 | 7.47 | TOP SHEETPILING |
| 417 | 547626.64 | 3694917.36 | 7.86 | TOP SHEETPILING |
| 418 | 547626.88 | 3694917.27 | 8.23 | TOP CONC FLDWALL |
| 419 | 547639.32 | 3694924.13 | 8.22 | TOP CONC FLDWALL |
| 420 | 547645.81 | 3694913.47 | 8.15 | TOP CONC FLDWALL |
| 421 | 547647.60 | 3694914.20 | 8.12 | TOP CONC FLDWALL |
| 422 | 547648.44 | 3694913.01 | 7.76 | TOP SHEETPILING |
| 423 | 547676.92 | 3694915.74 | 7.65 | TOP SHEETPILING |
| 424 | 547677.36 | 3694916.15 | 7.09 | TOP CONC BAG |
| 425 | 547737.68 | 3694917.60 | 6.85 | TOP CONC BAG |
| 426 | 547784.56 | 3694913.98 | 7.21 | TOP CONC BAG |
| 427 | 547840.37 | 3694904.41 | 7.09 | TOP CONC BAG |
| 428 | 547858.21 | 3694898.70 | 7.05 | TOP CONC BAG |
| 429 | 547876.46 | 3694890.97 | 6.53 | TOP CONC BAG |
| 430 | 547880.22 | 3694888.52 | 6.60 | DIRT RIP RAP PILE |
| 431 | 547900.17 | 3694885.17 | 6.92 | DIRT RIP RAP PILE |
| 432 | 547051.07 | 3694641.38 | 6.89 | DIRT RIP RAP PILE |
| 433 | 547039.87 | 3694650.53 | 11.93 | TOE |
| 434 | 547045.82 | 3694652.93 | 15.47 | TOP SPILE DAUPHIN |
| 435 | 547045.42 | 3694653.27 | 14.43 | DAUPHIN DIRT FILLED |
| 436 | 547022.38 | 3694672.60 | 14.61 | DAUPHIN DIRT FILLED |
| 437 | 546986.50 | 3694737.89 | 12.93 | DAUPHIN DIRT FILLED |
| 438 | 546956.83 | 3694792.46 | 14.54 | DAUPHIN DIRT FILLED |
| 439 | 546915.81 | 3694867.68 | 13.60 | DAUPHIN DIRT FILLED |
| 440 | 546902.78 | 3694894.84 | 14.61 | DAUPHIN DIRT FILLED |
| 441 | 546901.69 | 3694894.42 | 15.21 | TOP SPILE DAUPHIN |
| 442 | 546902.72 | 3694895.13 | 15.30 | EDGE CONC FLDWALL |
| 443 | 546901.88 | 3694896.18 | 15.34 | TOP CONC FLDWALL |
| 444 | 546901.78 | 3694896.40 | 14.36 | TOP CONC FLDWALL |
| 445 | 546889.19 | 3694920.82 | 14.38 | TOP CONC FLDWALL |
| 446 | 546877.69 | 3694941.42 | 14.36 | TOP CONC FLDWALL |
| 447 | 546877.59 | 3694941.70 | 14.70 | TOP CONC FLDWALL |
| 448 | 546829.38 | 3695030.01 | 14.43 | TOP CONC FLDWALL |
| 449 | 546794.18 | 3695094.22 | 14.33 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 450 | 546779.88 | 3695120.10 | 14.23 | TOP CONC FLDWALL |
| 451 | 546780.16 | 3695119.98 | 14.20 | FLDWALL BLOWOUT |
| 452 | 546778.38 | 3695125.29 | 13.95 | FLDWALL BLOWOUT |
| 453 | 546777.71 | 3695126.20 | 10.30 | FLDWALL BLOWOUT |
| 454 | 546774.10 | 3695130.36 | 9.18 | FLDWALL BLOWOUT |
| 455 | 546773.09 | 3695132.72 | 13.95 | FLDWALL BLOWOUT |
| 456 | 546772.41 | 3695133.86 | 14.04 | TOP CONC FLDWALL |
| 457 | 546770.37 | 3695137.67 | 14.02 | TOP CONC FLDWALL |
| 458 | 546683.06 | 3695175.19 | 14.30 | TOP CONC FLDWALL |
| 459 | 546603.44 | 3695209.19 | 14.07 | TOP CONC FLDWALL |
| 460 | 546508.65 | 3695249.57 | 14.34 | TOP CONC FLDWALL |
| 461 | 546441.68 | 3695269.17 | 14.52 | TOP CONC FLDWALL |
| 462 | 546358.50 | 3695293.25 | 14.62 | TOP CONC FLDWALL |
| 463 | 546320.84 | 3695304.23 | 14.74 | TOP CONC FLDWALL |
| 464 | 546316.53 | 3695302.77 | 14.70 | TOP CONC FLDWALL |
| 465 | 546316.20 | 3695302.74 | 14.33 | TOP CONC FLDWALL |
| 466 | 546239.77 | 3695269.74 | 14.33 | TOP CONC FLDWALL |
| 467 | 546141.22 | 3695227.14 | 14.31 | TOP CONC FLDWALL |
| 468 | 546079.05 | 3695240.57 | 14.28 | TOP CONC FLDWALL |
| 469 | 546025.95 | 3695252.28 | 14.31 | TOP CONC FLDWALL |
| 470 | 545958.19 | 3695273.47 | 14.28 | TOP CONC FLDWALL |
| 471 | 545883.57 | 3695296.78 | 14.30 | TOP CONC FLDWALL |
| 472 | 545865.28 | 3695292.36 | 14.30 | TOP CONC FLDWALL |
| 473 | 545773.47 | 3695271.47 | 14.30 | TOP CONC FLDWALL |
| 474 | 545773.29 | 3695271.48 | 14.78 | TOP CONC FLDWALL |
| 475 | 545768.23 | 3695270.29 | 14.76 | TOP CONC FLDWALL |
| 476 | 545732.73 | 3695276.59 | 14.71 | TOP CONC FLDWALL |
| 477 | 545676.51 | 3695245.82 | 14.80 | TOP CONC FLDWALL |
| 478 | 545606.18 | 3695207.57 | 14.66 | TOP CONC FLDWALL |
| 479 | 545544.46 | 3695225.32 | 14.82 | TOP CONC FLDWALL |
| 480 | 545544.14 | 3695225.03 | 15.03 | TOP CONC FLDWALL |
| 481 | 545536.90 | 3695227.19 | 15.11 | EDGE CONC FLDWALL |
| 482 | 545536.73 | 3695227.25 | 9.53 | TOE FLDGATE |
| 483 | 545490.89 | 3695240.72 | 9.49 | TOE FLDGATE |
| 484 | 545490.79 | 3695240.75 | 15.05 | EDGE CONC FLDWALL |
| 485 | 545483.68 | 3695242.91 | 15.05 | TOP CONC FLDWALL |
| 486 | 545483.44 | 3695243.03 | 14.80 | TOP CONC FLDWALL |
| 487 | 545472.87 | 3695246.12 | 14.82 | TOP CONC FLDWALL |
| 488 | 545483.96 | 3695285.18 | 14.74 | TOP CONC FLDWALL |
| 489 | 545422.70 | 3695302.88 | 14.68 | TOP CONC FLDWALL |
| 490 | 545339.88 | 3695327.08 | 14.77 | TOP CONC FLDWALL |
| 491 | 545256.41 | 3695351.38 | 14.56 | TOP CONC FLDWALL |
| 492 | 545173.36 | 3695375.33 | 14.48 | TOP CONC FLDWALL |
| 493 | 545089.94 | 3695399.53 | 14.63 | TOP CONC FLDWALL |
| 494 | 545006.72 | 3695423.62 | 14.64 | TOP CONC FLDWALL |
| 495 | 544923.65 | 3695447.72 | 14.57 | TOP CONC FLDWALL |
| 496 | 544855.62 | 3695467.15 | 14.74 | TOP CONC FLDWALL |
| 497 | 544855.26 | 3695467.25 | 15.16 | TOP CONC FLDWALL |
| 498 | 544849.40 | 3695468.86 | 15.16 | EDGE CONC FLDWALL |
| 499 | 544849.19 | 3695469.01 | 9.89 | TOE FLDWALL |
| 500 | 544774.19 | 3695490.86 | 9.86 | TOE FLDWALL |
| 501 | 544773.99 | 3695490.79 | 15.11 | EDGE CONC FLDWALL |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 502 | 544768.09 | 3695492.39 | 15.13 | TOP CONC FLDWALL |
| 503 | 544767.78 | 3695492.58 | 14.62 | TOP CONC FLDWALL |
| 504 | 544753.42 | 3695497.32 | 14.62 | TOP CONC FLDWALL |
| 505 | 544756.01 | 3695506.18 | 14.64 | TOP CONC FLDWALL |
| 506 | 544694.55 | 3695524.08 | 14.55 | TOP CONC FLDWALL |
| 507 | 544611.34 | 3695548.21 | 14.50 | TOP CONC FLDWALL |
| 508 | 544528.15 | 3695572.36 | 14.61 | TOP CONC FLDWALL |
| 509 | 544462.40 | 3695591.50 | 14.73 | TOP CONC FLDWALL |
| 510 | 544462.17 | 3695591.59 | 14.31 | TOP CONC FLDWALL |
| 511 | 544389.64 | 3695612.53 | 14.38 | TOP CONC FLDWALL |
| 512 | 544389.51 | 3695612.64 | 14.76 | TOP CONC FLDWALL |
| 513 | 544314.17 | 3695634.37 | 14.63 | TOP CONC FLDWALL |
| 514 | 544236.40 | 3695623.66 | 14.74 | TOP CONC FLDWALL |
| 515 | 544221.42 | 3695573.14 | 14.77 | TOP CONC FLDWALL |
| 516 | 544162.03 | 3695590.19 | 14.76 | TOP CONC FLDWALL |
| 517 | 544161.96 | 3695590.39 | 15.11 | TOP CONC FLDWALL |
| 518 | 544155.94 | 3695592.20 | 15.15 | EDGE CONC FLDWALL |
| 519 | 544155.66 | 3695592.20 | 8.67 | TOE CONC FLDWALL |
| 520 | 544114.99 | 3695604.00 | 8.60 | TOE CONC FLDWALL |
| 521 | 544114.85 | 3695604.05 | 14.98 | EDGE CONC FLDWALL |
| 522 | 544108.83 | 3695605.79 | 15.10 | TOP CONC FLDWALL |
| 523 | 544108.56 | 3695605.98 | 14.74 | TOP CONC FLDWALL |
| 524 | 544026.21 | 3695629.95 | 14.60 | TOP CONC FLDWALL |
| 525 | 544034.67 | 3695659.03 | 14.70 | TOP CONC FLDWALL |
| 526 | 544031.53 | 3695660.11 | 14.72 | TOP CONC FLDWALL |
| 527 | 544031.39 | 3695660.24 | 14.21 | TOP CONC FLDWALL |
| 528 | 543968.82 | 3695678.12 | 14.26 | TOP CONC FLDWALL |
| 529 | 543968.32 | 3695677.69 | 15.04 | TOP CONC FLDWALL |
| 530 | 543961.91 | 3695680.09 | 15.03 | EDGE CONC FLDWALL |
| 531 | 543961.89 | 3695679.94 | 9.68 | TOE CONC FLDWALL |
| 532 | 543906.26 | 3695696.22 | 9.71 | TOE CONC FLDWALL |
| 533 | 543906.02 | 3695696.11 | 15.03 | EDGE CONC FLDWALL |
| 534 | 543899.45 | 3695698.28 | 15.09 | TOP CONC FLDWALL |
| 535 | 543899.26 | 3695698.35 | 14.32 | TOP CONC FLDWALL |
| 536 | 543849.58 | 3695712.86 | 14.25 | TOP CONC FLDWALL |
| 537 | 543849.35 | 3695712.87 | 14.71 | TOP CONC FLDWALL |
| 538 | 543843.69 | 3695714.53 | 14.76 | TOP CONC FLDWALL |
| 539 | 543851.45 | 3695740.34 | 14.73 | TOP CONC FLDWALL |
| 540 | 543847.61 | 3695741.35 | 14.73 | TOP CONC FLDWALL |
| 541 | 543847.45 | 3695741.47 | 14.23 | TOP CONC FLDWALL |
| 542 | 543799.37 | 3695755.43 | 14.23 | TOP CONC FLDWALL |
| 543 | 543732.47 | 3695774.73 | 14.29 | TOP CONC FLDWALL |
| 544 | 543732.25 | 3695774.77 | 14.46 | TOP CONC FLDWALL |
| 545 | 543727.41 | 3695776.23 | 14.52 | TOP CONC FLDWALL |
| 546 | 543690.05 | 3695803.59 | 14.14 | TOP CONC FLDWALL |
| 547 | 543627.59 | 3695821.56 | 14.29 | TOP CONC FLDWALL |
| 548 | 543544.30 | 3695845.74 | 14.36 | TOP CONC FLDWALL |
| 549 | 543461.13 | 3695869.75 | 14.18 | TOP CONC FLDWALL |
| 550 | 543405.91 | 3695885.74 | 14.23 | TOP CONC FLDWALL |
| 551 | 543371.58 | 3695895.84 | 14.30 | TOP CONC FLDWALL |
| 552 | 543364.99 | 3695873.65 | 14.41 | TOP CONC FLDWALL |
| 553 | 543311.01 | 3695889.25 | 14.76 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 554 | 543310.69 | 3695889.22 | 15.07 | TOP CONC FLDWALL |
| 555 | 543304.19 | 3695891.08 | 15.09 | EDGE CONC FLDWALL |
| 556 | 543304.11 | 3695890.98 | 9.91 | TOE CONC FLDWALL |
| 557 | 543262.98 | 3695903.16 | 9.89 | TOE CONC FLDWALL |
| 558 | 543262.84 | 3695903.22 | 15.03 | EDGE CONC FLDWALL |
| 559 | 543256.05 | 3695905.06 | 15.10 | TOP CONC FLDWALL |
| 560 | 543255.87 | 3695905.21 | 14.71 | TOP CONC FLDWALL |
| 561 | 543237.11 | 3695911.03 | 14.70 | TOP CONC FLDWALL |
| 562 | 543249.55 | 3695953.51 | 14.62 | TOP CONC FLDWALL |
| 563 | 543245.54 | 3695954.67 | 14.68 | TOP CONC FLDWALL |
| 564 | 543245.42 | 3695954.77 | 14.27 | TOP CONC FLDWALL |
| 565 | 543132.35 | 3695987.69 | 14.16 | TOP CONC FLDWALL |
| 566 | 543055.16 | 3696010.21 | 14.21 | TOP CONC FLDWALL |
| 567 | 543024.13 | 3696018.99 | 14.17 | TOP CONC FLDWALL |
| 568 | 543023.98 | 3696019.04 | 14.50 | TOP CONC FLDWALL |
| 569 | 543020.12 | 3696020.15 | 14.48 | TOP CONC FLDWALL |
| 570 | 543014.05 | 3695999.45 | 14.44 | TOP CONC FLDWALL |
| 571 | 542927.36 | 3696026.95 | 14.45 | TOP CONC FLDWALL |
| 572 | 542846.12 | 3696052.30 | 14.13 | TOP CONC FLDWALL |
| 573 | 542763.76 | 3696027.44 | 14.21 | TOP CONC FLDWALL |
| 574 | 542680.90 | 3696002.08 | 14.18 | TOP CONC FLDWALL |
| 575 | 542597.16 | 3695977.05 | 14.09 | TOP CONC FLDWALL |
| 576 | 542514.21 | 3695951.63 | 13.99 | TOP CONC FLDWALL |
| 577 | 542431.57 | 3695926.25 | 13.99 | TOP CONC FLDWALL |
| 578 | 542348.20 | 3695901.10 | 13.93 | TOP CONC FLDWALL |
| 579 | 542264.97 | 3695875.85 | 14.28 | TOP CONC FLDWALL |
| 580 | 542214.01 | 3695860.36 | 14.67 | TOP CONC FLDWALL |
| 581 | 542207.84 | 3695881.02 | 14.73 | TOP CONC FLDWALL |
| 582 | 542203.50 | 3695879.78 | 14.70 | TOP CONC FLDWALL |
| 583 | 542203.25 | 3695879.68 | 13.02 | TOP CONC FLDWALL |
| 584 | 542170.71 | 3695872.12 | 13.63 | TOP CONC FLDWALL |
| 585 | 542169.87 | 3695872.67 | 12.70 | TOP CONC FLDWALL |
| 586 | 542165.64 | 3695871.69 | 12.67 | TOP CONC FLDWALL |
| 587 | 542165.46 | 3695871.59 | 13.12 | TOP CONC FLDWALL |
| 588 | 542163.75 | 3695870.75 | 13.10 | EDGE CONC FLDWALL |
| 589 | 542163.79 | 3695870.43 | 9.65 | TOE CONC FLDWALL |
| 590 | 542119.99 | 3695860.17 | 9.70 | TOE CONC FLDWALL |
| 591 | 542119.85 | 3695860.15 | 13.27 | EDGE CONC FLDWALL |
| 592 | 542118.10 | 3695860.01 | 13.26 | TOP CONC FLDWALL |
| 593 | 542117.79 | 3695860.06 | 12.78 | TOP CONC FLDWALL |
| 594 | 542064.43 | 3695846.97 | 12.77 | TOP CONC FLDWALL |
| 595 | 542063.86 | 3695846.62 | 12.99 | TOP CONC FLDWALL |
| 596 | 542015.67 | 3695834.95 | 12.32 | TOP CONC FLDWALL |
| 597 | 541948.07 | 3695817.86 | 11.89 | TOP CONC FLDWALL |
| 598 | 541860.46 | 3695796.22 | 11.80 | TOP CONC FLDWALL |
| 599 | 541773.82 | 3695774.72 | 12.11 | TOP CONC FLDWALL |
| 600 | 541686.77 | 3695752.88 | 12.03 | TOP CONC FLDWALL |
| 601 | 541599.41 | 3695731.76 | 12.14 | TOP CONC FLDWALL |
| 602 | 541540.88 | 3695717.25 | 12.56 | TOP CONC FLDWALL |
| 603 | 541516.79 | 3695711.30 | 13.07 | TOP CONC FLDWALL |
| 604 | 541516.26 | 3695711.24 | 12.38 | TOP CONC FLDWALL |
| 605 | 541462.20 | 3695697.78 | 12.63 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 606 | 541461.95 | 3695697.57 | 13.22 | TOP CONC FLDWALL |
| 607 | 541460.16 | 3695696.49 | 13.21 | EDGE CONC FLDWALL |
| 608 | 541460.13 | 3695696.66 | 10.07 | TOE CONC FLDWALL |
| 609 | 541416.33 | 3695685.67 | 10.06 | TOE CONC FLDWALL |
| 610 | 541416.27 | 3695685.50 | 13.22 | EDGE CONC FLDWALL |
| 611 | 541414.46 | 3695685.42 | 13.27 | TOP CONC FLDWALL |
| 612 | 541414.30 | 3695685.37 | 12.68 | TOP CONC FLDWALL |
| 613 | 541387.44 | 3695678.77 | 12.46 | TOP CONC FLDWALL |
| 614 | 541377.74 | 3695662.62 | 12.51 | TOP CONC FLDWALL |
| 615 | 541374.26 | 3695665.06 | 12.50 | TOP CONC FLDWALL |
| 616 | 541374.09 | 3695664.80 | 13.22 | TOP CONC FLDWALL |
| 617 | 541372.37 | 3695665.40 | 13.21 | EDGE CONC FLDWALL |
| 618 | 541372.54 | 3695666.25 | 7.54 | TOE CONC FLDWALL |
| 619 | 541358.18 | 3695674.87 | 7.57 | TOE CONC FLDWALL |
| 620 | 541357.69 | 3695674.29 | 13.22 | EDGE CONC FLDWALL |
| 621 | 541356.34 | 3695675.52 | 13.26 | TOP CONC FLDWALL |
| 622 | 541356.10 | 3695675.71 | 12.51 | TOP CONC FLDWALL |
| 623 | 541314.78 | 3695700.62 | 12.50 | TOP CONC FLDWALL |
| 624 | 541312.71 | 3695701.52 | 12.51 | TOP CONC FLDWALL |
| 625 | 541307.73 | 3695693.67 | 12.48 | END CONC FLDWALL |
| 626 | 541202.69 | 3695756.73 | 12.45 | END CONC FLDWALL |
| 627 | 541158.76 | 3695782.92 | 12.56 | TOP CONC FLDWALL |
| 628 | 541128.36 | 3695732.27 | 12.55 | TOP CONC FLDWALL |
| 629 | 541102.23 | 3695688.13 | 12.50 | TOP CONC FLDWALL |
| 630 | 541106.13 | 3695670.94 | 12.59 | TOP CONC FLDWALL |
| 631 | 541105.65 | 3695670.99 | 12.61 | TOP CONC FLDWALL |
| 632 | 541105.44 | 3695670.71 | 21.18 | TOP CONC FLDWALL |
| 633 | 541103.18 | 3695669.47 | 21.17 | EDGE CONC FLDWALL |
| 634 | 541102.49 | 3695669.82 | 5.25 | TOE FLDGATE |
| 635 | 541071.05 | 3695663.20 | 5.12 | TOE FLDGATE |
| 636 | 541071.05 | 3695663.08 | 13.34 | EDGE CONC FLDWALL |
| 637 | 541071.85 | 3695660.73 | 13.32 | TOP CONC FLDWALL |
| 638 | 541071.86 | 3695660.52 | 12.55 | TOP CONC FLDWALL |
| 639 | 541079.50 | 3695633.92 | 12.49 | TOP CONC FLDWALL |
| 640 | 541075.39 | 3695632.68 | 12.50 | TOP CONC FLDWALL |
| 641 | 541075.21 | 3695633.79 | 12.51 | TOP CONC FLDWALL |
| 642 | 541042.13 | 3695625.59 | 12.41 | TOP CONC FLDWALL |
| 643 | 541056.47 | 3695567.24 | 12.51 | TOP CONC FLDWALL |
| 644 | 541047.06 | 3695541.63 | 12.58 | TOP CONC FLDWALL |
| 645 | 541047.03 | 3695541.52 | 13.14 | TOP CONC FLDWALL |
| 646 | 541046.44 | 3695539.78 | 13.14 | TOP CONC FLDWALL |
| 647 | 541046.36 | 3695539.56 | 12.52 | TOP CONC FLDWALL |
| 648 | 541036.23 | 3695511.98 | 12.52 | TOP CONC FLDWALL |
| 649 | 541036.68 | 3695511.86 | 16.76 | TOP CONC FLDWALL |
| 650 | 541035.90 | 3695509.93 | 16.67 | EDGE CONC FLDWALL |
| 651 | 541034.88 | 3695509.52 | 7.84 | TOE FLDGATE |
| 652 | 541025.36 | 3695483.39 | 7.72 | TOE FLDGATE |
| 653 | 541025.98 | 3695482.74 | 13.77 | EDGE CONC FLDWALL |
| 654 | 541024.75 | 3695481.21 | 13.82 | TOP CONC FLDWALL |
| 655 | 541024.72 | 3695480.93 | 12.47 | TOP CONC FLDWALL |
| 656 | 541022.71 | 3695476.06 | 12.48 | TOP CONC FLDWALL |
| 657 | 541008.85 | 3695472.68 | 12.58 | TOP CONC FLDWALL |

| Name | Northing | Easting | Elevation | Feature Code |
|---|---|---|---|---|
| 658 | 541008.78 | 3695472.45 | 13.98 | TOP CONC FLDWALL |
| 659 | 540975.95 | 3695464.55 | 13.72 | TOP CONC FLDWALL |
| 660 | 540975.49 | 3695464.57 | 12.57 | TOP CONC FLDWALL |
| 661 | 540889.57 | 3695380.95 | 6.39 | TOP CONC FLDWALL |
| 662 | 540886.93 | 3695441.90 | 12.55 | EDGE CONC FLDWALL |
| 663 | 540884.39 | 3695440.22 | 0.11 | TOE FLDGATE |
| 664 | 540845.79 | 3695430.78 | 0.23 | TOE FLDGATE |
| 665 | 540842.93 | 3695430.67 | 12.61 | EDGE CONC FLDWALL |
| 667 | 540810.11 | 3695423.03 | 12.83 | TOP CONC FLDWALL |
| 668 | 540809.27 | 3695423.34 | 12.79 | TOP CONC FLDWALL |
| 669 | 540801.93 | 3695420.84 | 12.71 | EDGE CONC FLDWALL |
| IHNC5 | 541419.07 | 3695686.94 | 9.96 | CHISELED X |
| IHNC6 | 541436.98 | 3695528.23 | 4.95 | PK NAIL |
| IHNC7 | 540899.42 | 3695300.31 | 0.57 | PK NAIL |
| IHNC8 | 540944.19 | 3695118.09 | -0.35 | PK NAIL |
| OP17 | 542897.98 | 3688637.67 | -2.15 | RTK BASE |
| TBM FRANCE | 543277.04 | 3694356.36 | 4.53 | CHK |

# Appendix 15
# Lake Pontchartrain/IHNC Gage Connections

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

## Gage Name/ Site

### USGS at I-10 and Inner Harbor Navigation Canal (IHNC)

| | | Field Book Reference | |
|---|---|---|---|
| **Control Point Name** | **Elevation** | **Book** | **Page** |
| RP-1 | 10.09' | 060855 | 36 |
| B 3130 Reset (PID = BJ 5311) | 9.68' | 060855 | 37 |

### Orleans Levee District Staff Gage at I-10 and IHNC

| | | Field Book Reference | |
|---|---|---|---|
| **Control Point Name** | **Elevation** | **Book** | **Page** |
| Staff Gage -10' Mark | 9.62' | 060855 | 36 |

### USGS Gage at Paris Road(I-510) bridge over IWW

| | | Field Book Reference | |
|---|---|---|---|
| **Control Point Name** | **Elevation** | **Book** | **Page** |
| RP-1 | 6.50' | 060850 | 27 |

### Orleans Levee District Gage at Southshore Marina

| | | Field Book Reference | |
|---|---|---|---|
| **Control Point Name** | **Elevation** | **Book** | **Page** |
| Staff Gage - 0' Mark | -0.08' | 060850 | 28-31 |
| 1A ( PID-BJ1394 Original reference point) | 8.33' | 060850 | 28-31 |
| RP-A (New reference point set) | 4.42' | 060850 | 28-31 |

## Pass Manchac at Turtle Cove at Pontchatoula, LA

| Control Point Name | Elevation | Field Book Reference Book | Page |
|---|---|---|---|
| GPS-1 | 2.84' | 060850 | 25-26 |
| RP-1 | 2.41' | 060850 | 25-26 |
| RM-1 | 2.45 | 060850 | 25-26 |

## Little Irish Bayou near HWY 11 near Slidell, LA

| Control Point Name | Elevation | Field Book Reference Book | Page |
|---|---|---|---|
| AGO6 | 3.62' | 060855 | 27 |
| GPS-1 | 4.96' | 060855 | 27 |
| RM-1 | 5.00' | 060855 | 27 |
| RP-1 | 9.67' | 060855 | 27 |
| RM-2 | 5.02' | 060855 | 27 |

## Weather Service Mid-Lake Gage

| Control Point Name | Elevation | Field Book Reference Book | Page |
|---|---|---|---|
| AGO7 | 9.07' | 060858 | 29 |
| SCREW | 11.97' | 060858 | 29 |
| RM-1 | 9.06' | 060858 | 29 |
| Top Lip PVC Pipe | 12.92' | 060858 | 29 |

## USGS and Orleans Levee District Gages at I-10 and Inner Harbor Navigation Canal (IHNC).


USGS Gage at I-10 and IHNC
Elevation taken on Iron directly over transducer pipe = 10.09' NAVD88(2004.65)
Bk. 060855, Pg.36

Orleans Levee District Staff Gage
10' Mark = 9.62' NAVD88(2004.65)
Bk. 060855, Pg.36

Additional Photo of both gages.

## USGS Gage at Paris Road (I 510) Bridge over the IWW

USGS Paris Road Gage, Elevation = 6.50’ NAVD88(2004.65)
Bk. 060850, Pg 27

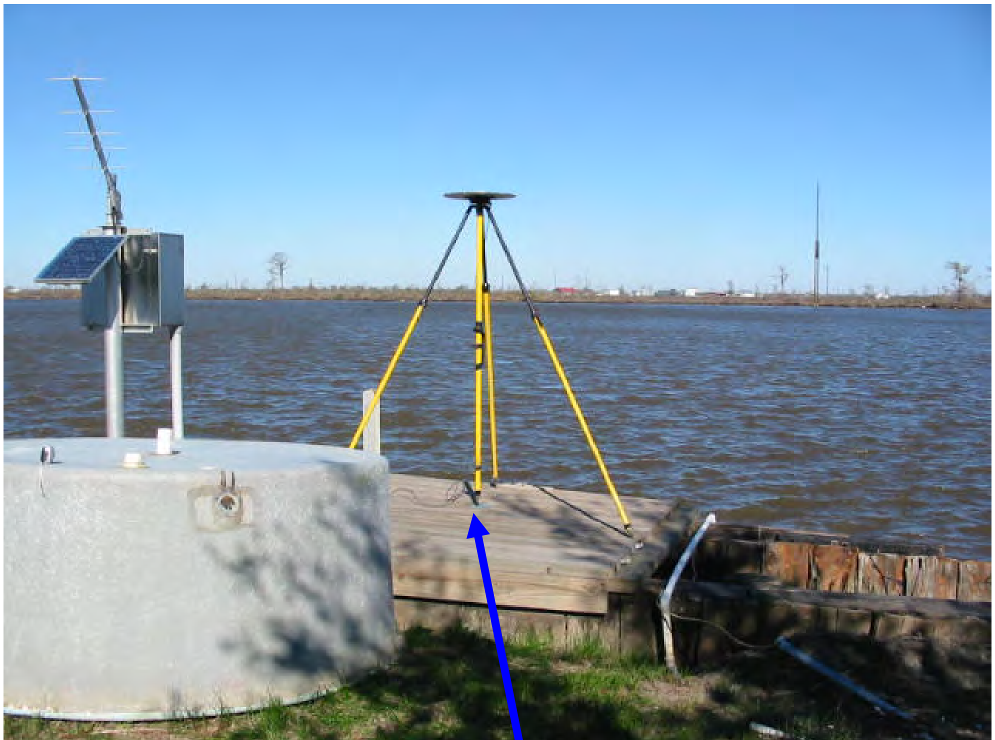
Red circles on photo are where elevation was taken.

## Orleans Levee District gage at Southshore Marina

Southshore Marina Gage Staff Gage elevation at reading 0’ = -0.79’, New reference point RP-A Elevation = 4.42’, Original reference point PID BJ1394 = 8.33’ NAVD88(2004.65), Bk. 060850, Pgs. 28-31

The above photo shows location of RP-A and red circle shows staff gage.

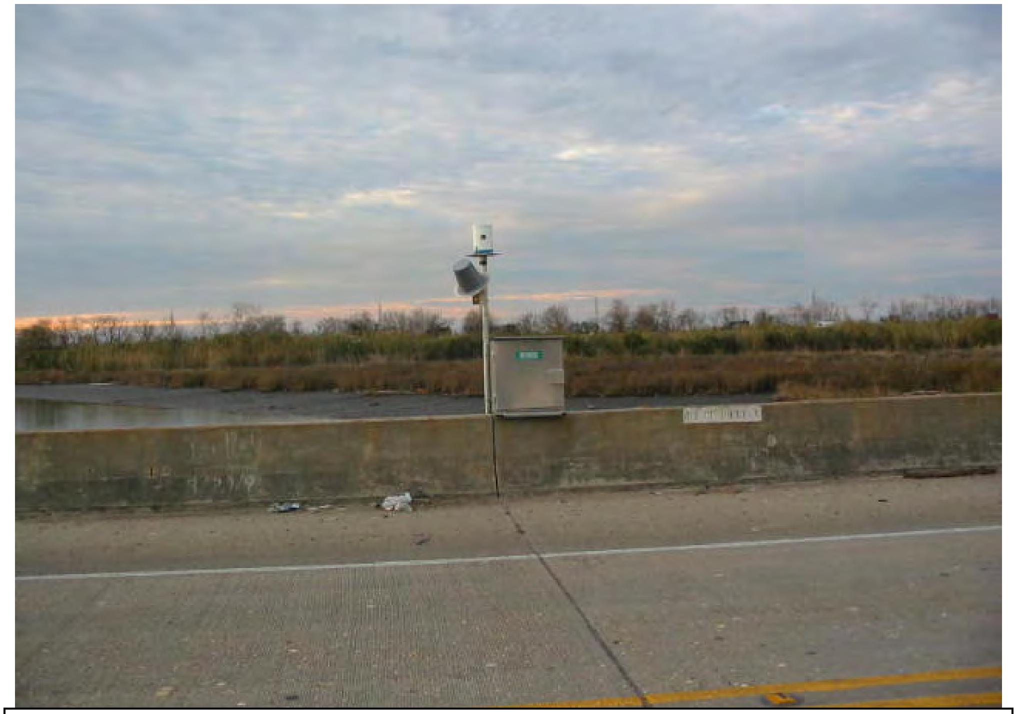
# Pass Manchac at Turtle Cove Pontchatoula, LA



Pass Manchac at Turtle Cove, Shot GPS-1 = 2.84’ NAVD88(2004.65), Bk. 060850, Pg. 25-26

Additional Photo of Pass Manchac at Turtle Cove below.

## Little Irish Bayou near HWY 11 in Slidell, La



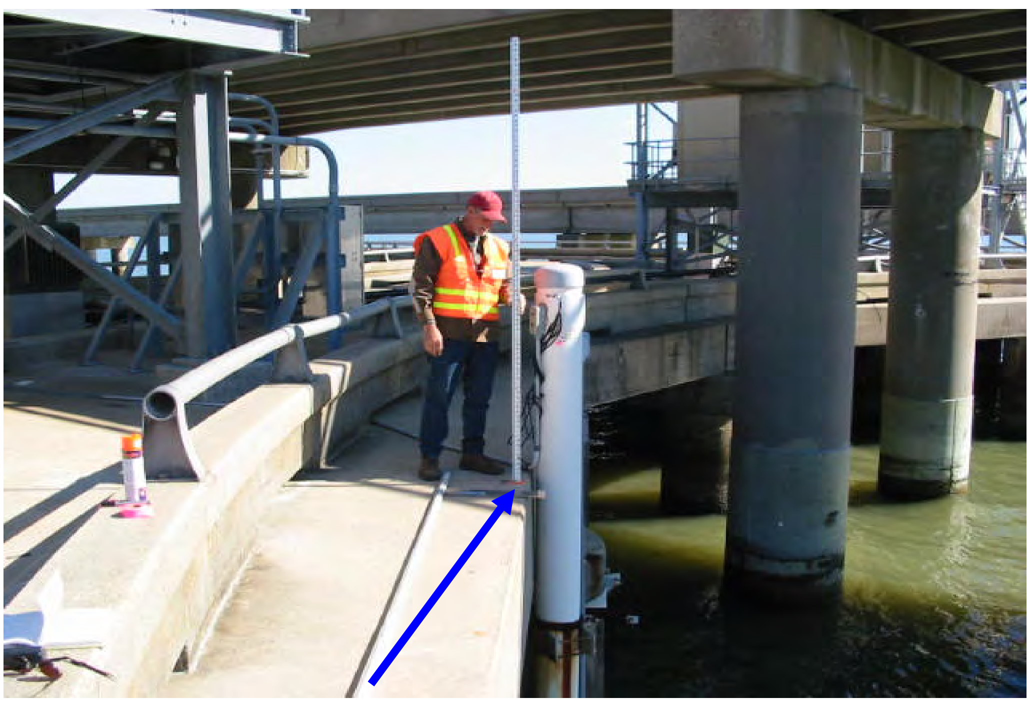
Little Irish Bayou, Shot GPS-1 = 4.96’, AGO6 = 3.62’, RM-1 = 5.00’, RP-1 = 9.67’, and RM-2 = 5.02’, NAVD88(2004.65), Bk. 060855, Pg. 27

## Weather Service Mid-Lake Gage

GPS Point -AGO7 = 9.04' NAVD88(2004.65)
Bk. 060858 Pg. 29

Shot at screw on gage = 11.97' NAVD88(2004.65), Bk. 060858 Pg. 29

Shot at top lip PVC Pipe = 12.92’ NAVD88(2004.65), Bk. 060858 Pg. 29



Shot RM-1 = 9.06’ NAVD88(2004.65), Bk. 060858 Pg. 29

# Appendix 16
# Time Stamped Surge Elevations - New Orleans Lakefront Airport

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

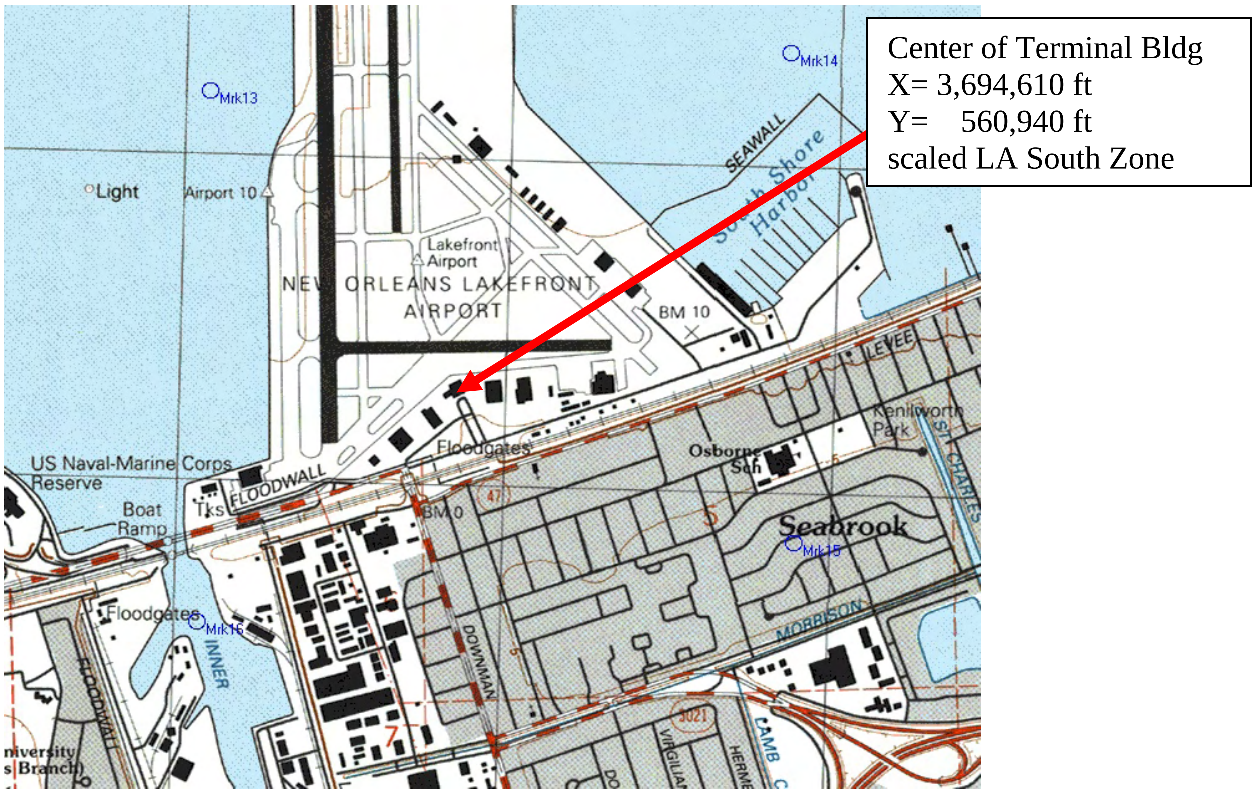
**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| High Water Marks at Lakefront Airport | | | |
|---|---|---|---|
| | **NAVD88(2004.65)** | **Reference** | |
| | **FEET** | **Book** | **Page** |
| HWM APH 01 | 6.72 | 060851 | 68-69 |
| HWM APH 02 | 9.54 | 060851 | 68-69 |
| HWM APH 03 | 10.63 | 060851 | 33 |
| HWM APH 04 | 11.99 | 060851 | 33 |
| HWM APH 05 | 11.30 | 060851 | 33 |
| HWM APH 06 | 9.65 | 060851 | 33 |
| HWM APH 07 | 11.56 | 060851 | 68-69 |
| HWM APH 08 | 10.20 | 060851 | 68-69 |
| HWM APH 09 | 8.89 | 060851 | 68-69 |
| HWM APH 10 | 10.26 | 060851 | 68-69 |
| HWM APH 11 | 7.35 | 060851 | 68-69 |
| HWM APH 12 | 7.06 | 060851 | 68-69 |
| HWM APH 13 | 8.25 | 060851 | 68-69 |

The following sheets contain Lake Pontchartrain surge elevations during the morning of 29 Aug 05. These points were marked by Maynord and Bergen on 15 Dec 05, based on photographs taken by Orleans Levee Board personnel (Fred Pruitt) who rode out Hurricane Katrina in the airport terminal building.

Water surface elevation marks were surveyed by differential leveling on 16 Dec 05, by 3001, Inc. Points are referenced to CHL photo numbers and time (LST). Data on additional HWM points not referenced by CHL photo and time are in other CHL (Maynord) files. All elevations are referenced to the updated time dependent vertical datum for the New Orleans region—NAVD88 (2004.65). Approximate horizontal locations of the marks are as described.

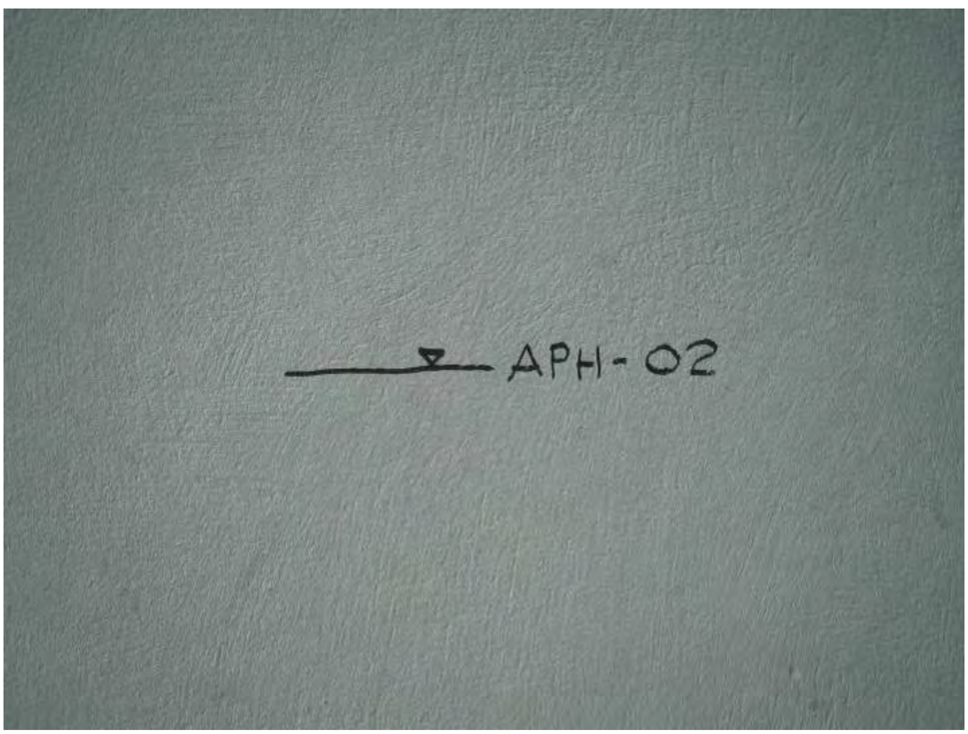


APH-01
TIME 7:38 AM (CHL Photo 1b)
On concrete barrier at terminal entrance

ELEVATION 6.72 FT NAVD88 (2004.65)


APH-02
TIME 10:31 AM (CHL Photo 1f)
On wall NW side of terminal

ELEVATION 9.54 FT NAVD88 (2004.65)

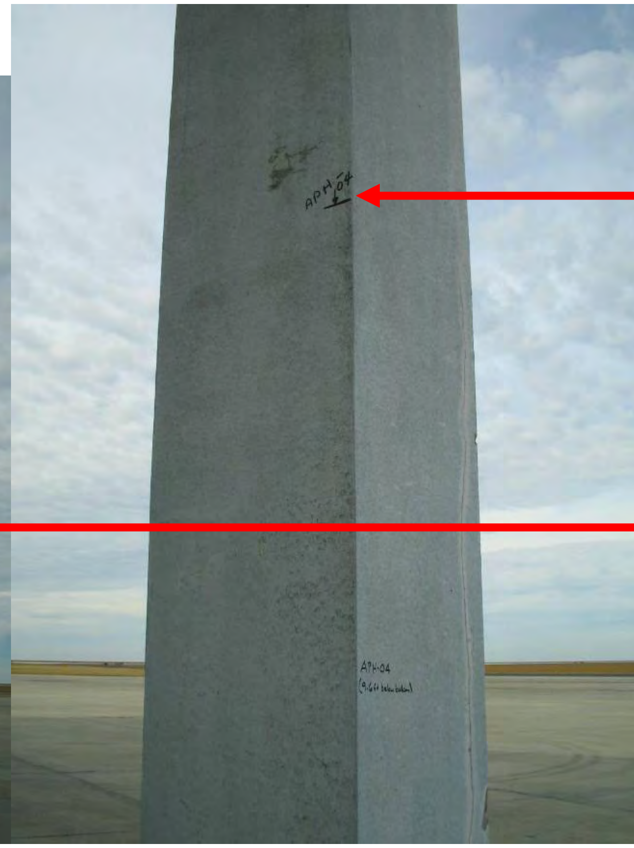


APH-03
TIME 9:42 AM (CHL Photo 1d)
On column NE side of terminal building

ELEVATION 10.63 FT NAVD88 (2004.65)

APH-04
TIME 9:40 AM (CHL Photo 1d)
NE side of terminal bldg
Mark 9.6 ft below bottom of balcony

ELEVATION 11.99 FT NAVD88 (2004.65)

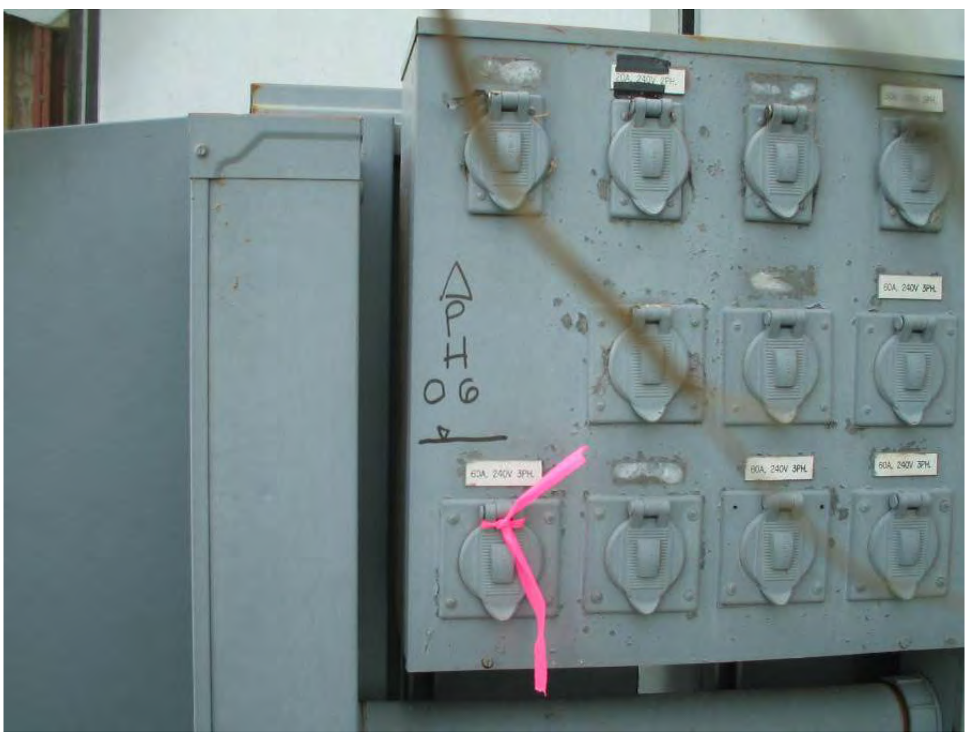


APH-05
TIME ? (no CHL Photo )
NE side of terminal bldg
marked by flagging on fence

ELEVATION 11.30 FT NAVD88 (2004.65)

APH-06
TIME ?  (no CHL Photo )
NE side of terminal bldg
mark on elec switch box inside fence

ELEVATION   9.65 FT   NAVD88 (2004.65)

APH-07
TIME – Post-Katrina HWM (CHL Photo 1a )
NW office inside terminal bldg
Debris line on wall inside Landry's office

ELEVATION 11.56 FT NAVD88 (2004.65)


APH-08
TIME – 11:05 AM (CHL Photo 1g)
Column inside terminal bldg

ELEVATION 10.20 FT NAVD88 (2004.65)

APH-09
TIME – 12:08 PM (CHL Photo 1h )
Column inside terminal bldg

APH-10
TIME – ? (no CHL Photo )
Inside terminal bldg—East side
on elevator framework (Room 101)

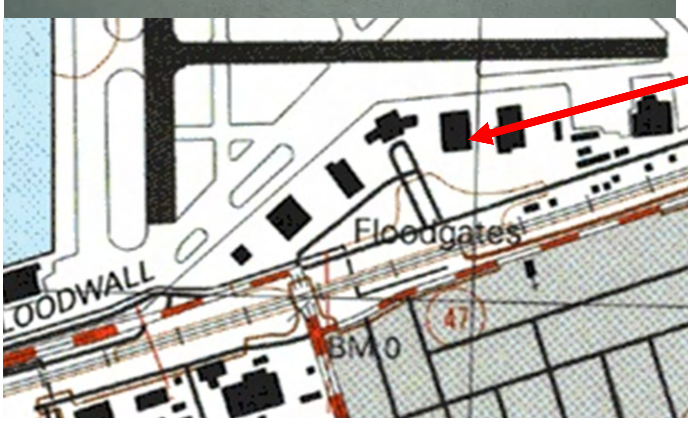
ELEVATION 10.26 FT NAVD88 (2004.65)

APH-11
TIME – ? (no CHL Photo)
NW side of terminal bldg
on bottom chord of channel

ELEVATION 7.35 FT NAVD88 (2004.65)

APH-12
TIME – ? (no CHL Photo)
NW corner of bldg 200 ft east
of main terminal bldg
below window frame

ELEVATION 7.06 FT NAVD88 (2004.65)


NW corner of building
east of main terminal

APH-13
TIME – 12:51 PM (CHL Photo 1i)
NW corner of bldg 200 ft east
of main terminal

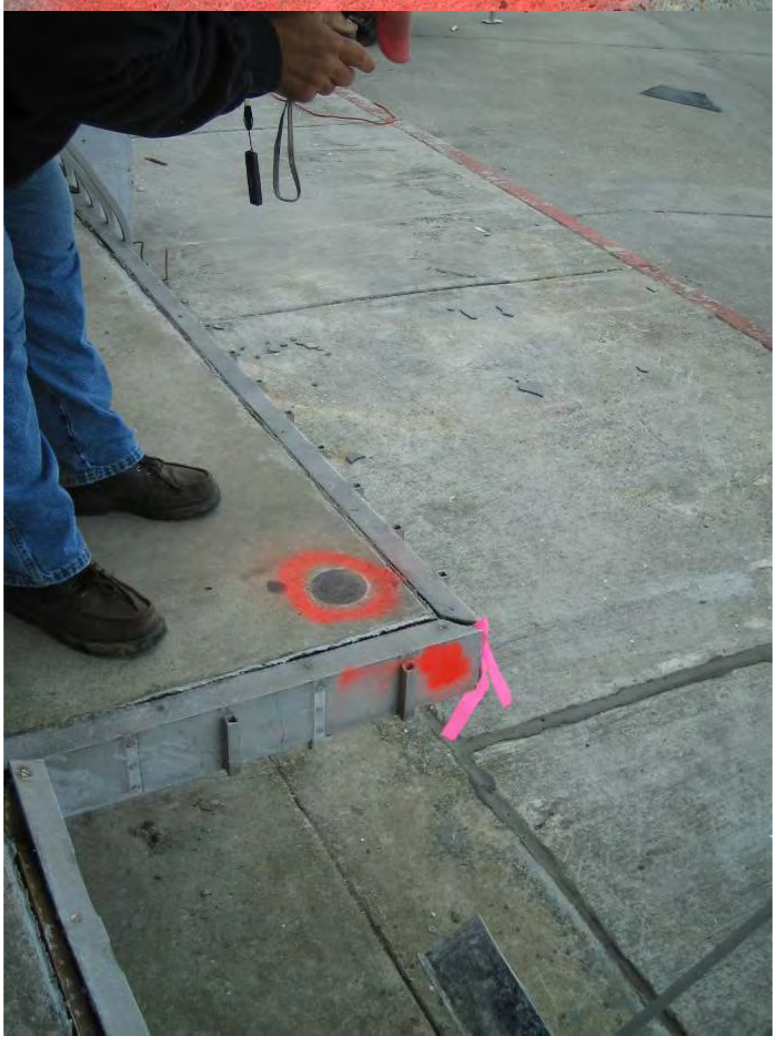
ELEVATION 8.25 FT NAVD88 (2004.65)

APH-14
TIME – ?  (no CHL Photo)
HWM on rail vicinity floodwall & floodgate
SSW of main terminal bldg
(ref CHL Lear Jet photo)

ELEVATION  7.04  FT   NAVD88 (2004.65)

USC&GS BM Y 162 RESET (1963) [for reference elevation only—not a HWM point]
located on loading platform on north side of main terminal bldg


ELEVATION 8.42 FT NAVD88 (2004.65)



# Appendix 17
# Time Stamped Surge Elevations – Orleans Marina (Near New Canal at Lakefront)

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

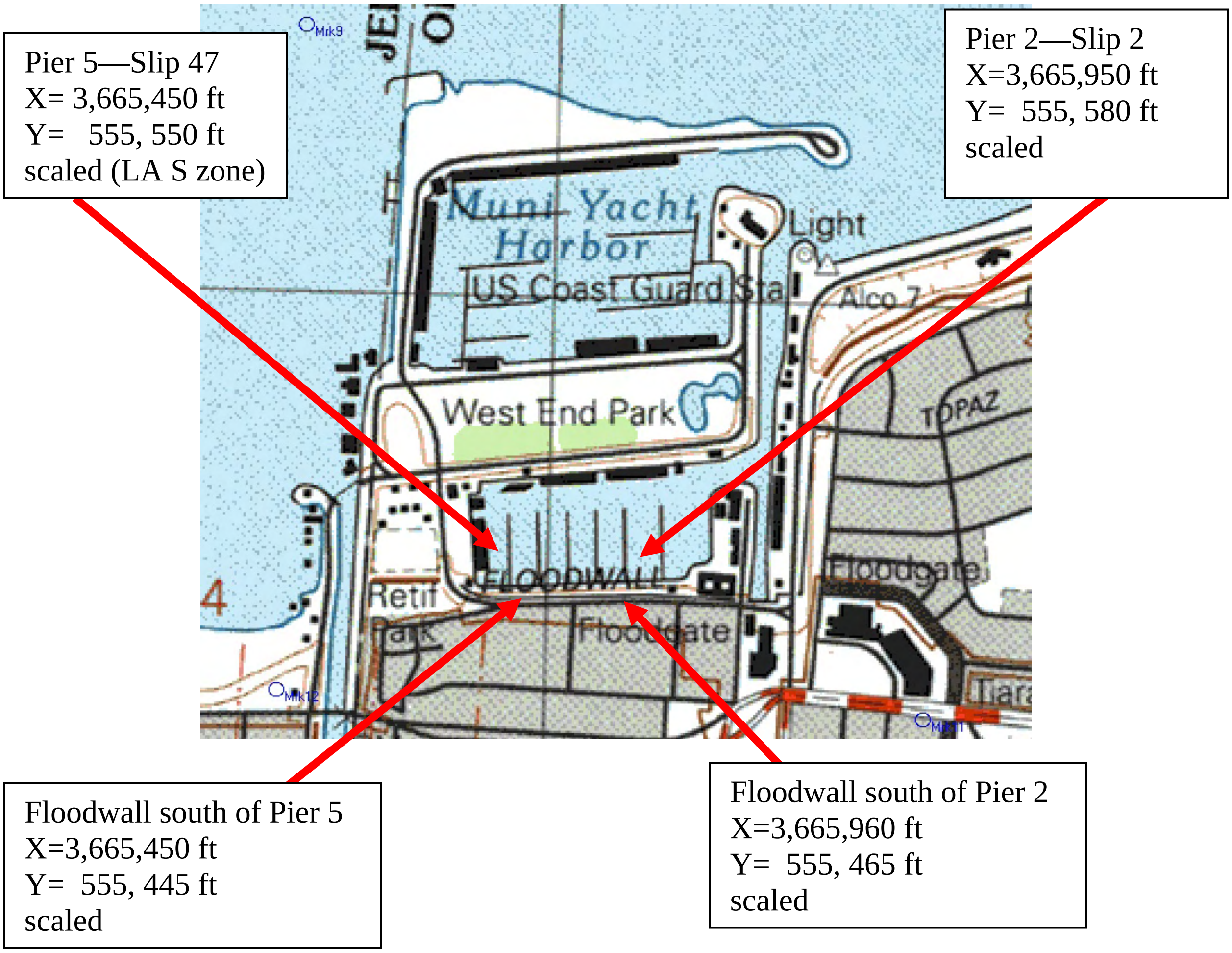
**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| High Water Marks at Orleans Marina | | | |
|---|---|---|---|
| | NAVD88(2004.65) | Reference | |
| | FEET | Book | Page |
| HWM OM 1 | 2.97 | 060851 | 70 |
| HWM OM 2 | 3.73 | 060851 | 70 |
| HWM OM 3 | 5.06 | 060851 | 70 |
| HWM OM 4 | 7.01 | 060851 | 70 |
| HWM OM 5 | 7.00 | 060851 | 70 |
| HWM OM 6 | 10.07 | 060851 | 70 |
| HWM OM 7 | 11.89 | 060851 | 70 |
| HWM OM 8 | 9.81 | 060851 | 70 |
| HWM OM 9 | 12.52 | 060851 | 70 |

The following sheets contain Lake Pontchartrain surge elevations during the morning of 29 Aug 05. These points were marked by Maynord and Bergen on 15 Dec 05, based on logged visual observations by the owner of the vessel “Kaui Girl” who rode out Hurricane Katrina in the southerly basin of Orleans Marina (Pier 2—Slip 2).

Water surface elevation marks were surveyed by differential leveling on 16 & 22 Dec 05, by 3001, Inc. All elevations are referenced to the updated time dependent vertical datum for the New Orleans region—NAVD88 (2004.65). Horizontal locations of the marks are scaled.


Pier 5—Slip 47
X= 3,665,450 ft
Y= 555, 550 ft
scaled (LA S zone)
Pier 2—Slip 2
X=3,665,950 ft
Y= 555, 580 ft
scaled
Floodwall south of Pier 5
X=3,665,450 ft
Y= 555, 445 ft
scaled
Floodwall south of Pier 2
X=3,665,960 ft
Y= 555, 465 ft
scaled
Muni Yacht Harbor
US Coast Guard Sta
Light
Alco 7
West End Park
TOPAZ
FLOODWALL
Floodgate
Floodgate
Retif Park
Tiara

OM-01
TIME 1:30 AM
Bottom of catwalk 2x6  (Pier 2 Slip 2)

ELEVATION  2.97  FT NAVD88 (2004.65)

OM-02
TIME ? (between 1:30 AM and 4:00 AM?)
Top of 1st 2x12 step (Pier 2 Slip 2)

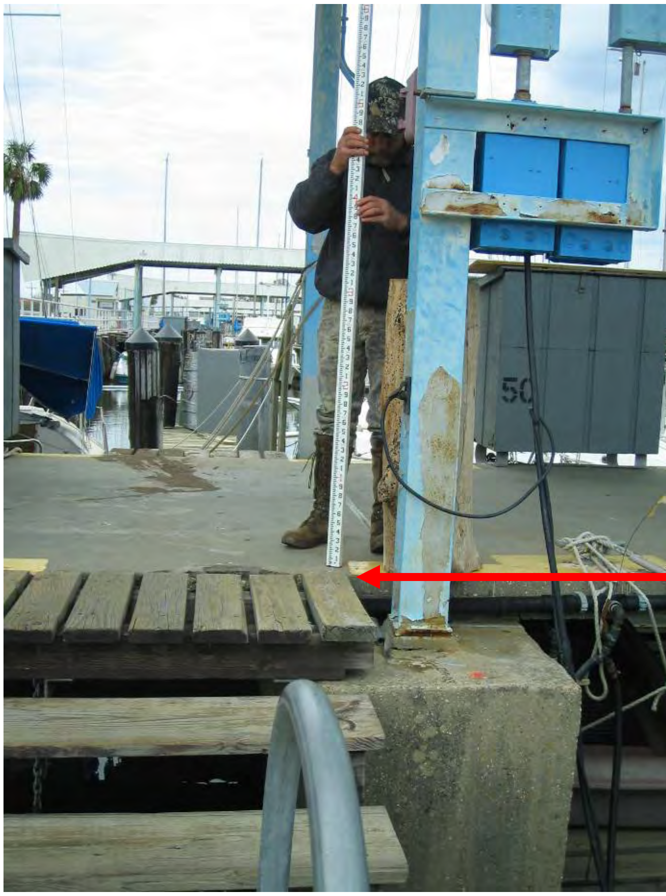
ELEVATION 3.73 FT NAVD88 (2004.65)


OM-03
TIME 4:00 AM
Top of Concrete Pile Cap (Pier 2 Slip 2)

ELEVATION 5.06 FT NAVD88 (2004.65)


OM-04
TIME 6:00 AM
Top of Concrete Pier (Pier 2 Slip 2)

ELEVATION 5.61 FT NAVD88 (2004.65)




OM-05
TIME 6:15 AM
Top of 1st Railing on Bulkhead (East of Pier 2)

ELEVATION 7.00 FT NAVD88 (2004.65)

1ST Rail (rod not on rail during photo)

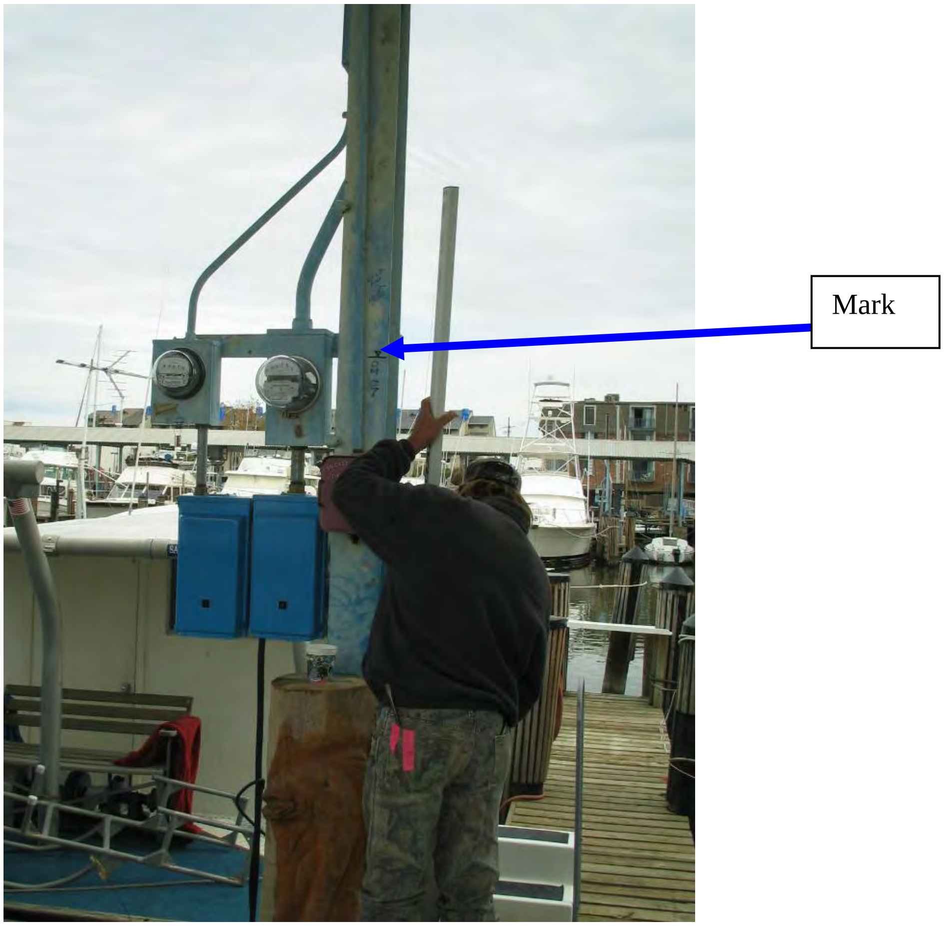
OM-06
TIME 10:00 AM
Top Rail on Bulkhead (East of Pier 2)

ELEVATION 10.07 FT NAVD88 (2004.65)

Top Rail

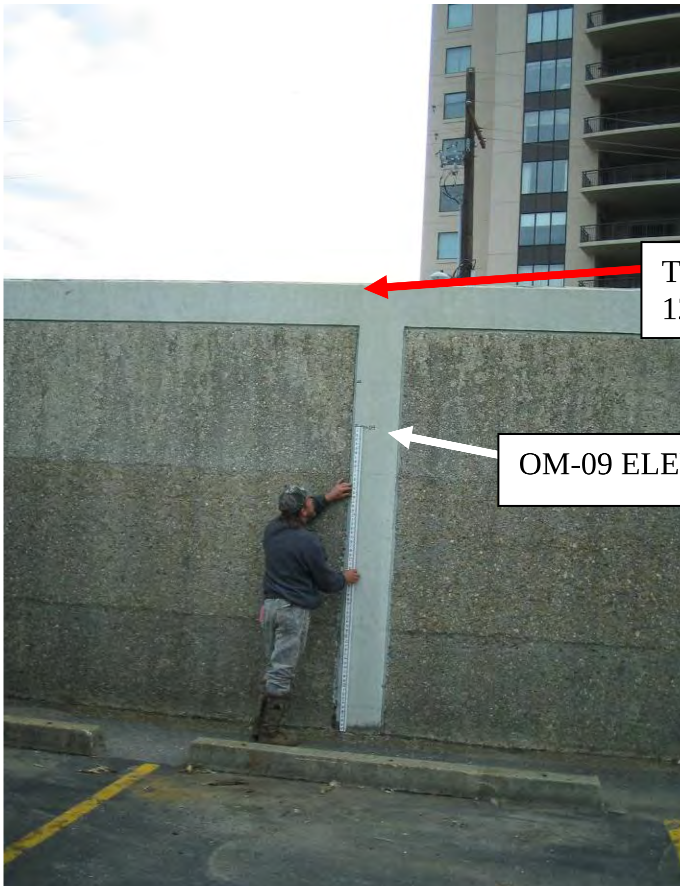
OM-07
TIME 11:00 AM
Steel Column on Pier (Pier 2 Slip 2)

ELEVATION 11.91 FT NAVD88 (2004.65)



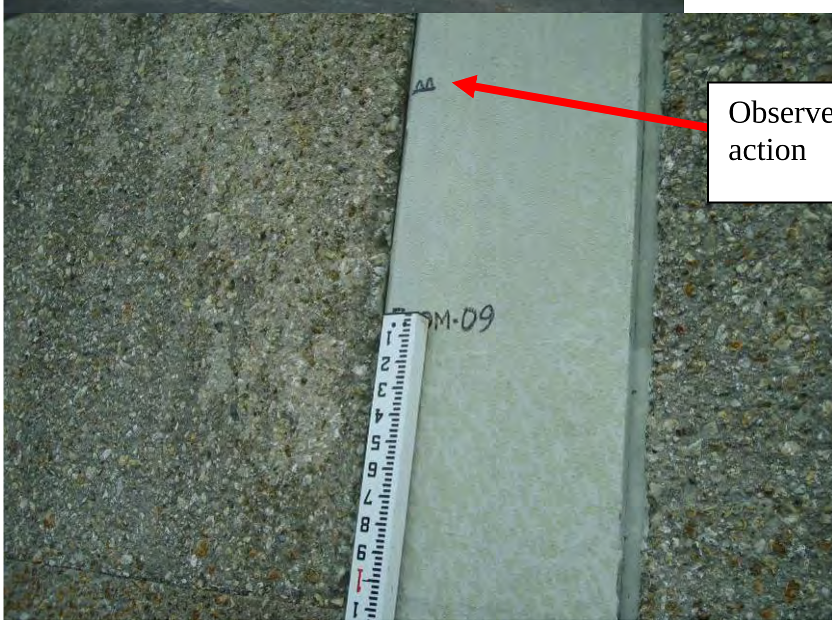

OM-08
TIME >11:00 AM (HWM Crest)
HWM determined by computing vessel lift to canopy during surge—comparing damage on vessel transom which was lifted 9.6 ft up to damaged metal roof. Accuracy estimated at +/- 0.5 ft given uncertainty of damage references. (Location Pier 5 Slip 47 – west of Pier 2)

OM-09
TIME >11:00 AM (HWM Crest)
E-W Floodwall directly south of Pier 2



TOP OF FLOODWALL ELEVATION
12.49 FT NAVD88 (2004.65)

OM-09 ELEVATION 9.18 FT NAVD88 (2004.65)



Observer's estimate of top of wave action

Top of floodwall due south of Pier 5 12.52 feet.
(Used as check with prior MVN surveys of same floodwall ... checked to ±0.05 ft)

# Appendix 18
# Topographic and Hydrographic Cross Section Data

## 17th Street Canal

**Horizontal Datum: NAD 1983(1992)**

**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**

**Vertical Datum: NAVD88(2004.65)**

**Coordinate Units: US survey feet**

**Distance Units: U.S. survey feet**

**Height Units: U.S. survey feet**

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 4+50 Pt01 | 554308.30 | 3664395.55 | -4.57 | SND | Book# 060856 |
| 4+50 Pt02 | 554309.05 | 3664385.58 | -8.67 | SND | Book# 060856 |
| 4+50 Pt03 | 554309.80 | 3664375.61 | -13.27 | SND | Book# 060856 |
| 4+50 Pt04 | 554310.55 | 3664365.64 | -14.67 | SND | Book# 060856 |
| 4+50 Pt05 | 554311.30 | 3664355.67 | -14.97 | SND | Book# 060856 |
| 4+50 Pt06 | 554312.04 | 3664345.69 | -16.17 | SND | Book# 060856 |
| 4+50 Pt07 | 554313.54 | 3664325.75 | -10.97 | SND | Book# 060856 |
| 4+50 Pt08 | 554314.29 | 3664315.78 | -18.07 | SND | Book# 060856 |
| 4+50 Pt09 | 554314.29 | 3664315.78 | -18.07 | CL | Book# 060856 |
| 4+50 Pt10 | 554304.86 | 3664411.67 | 1.63 | TOE CONC FLDWALL | 17thLONDON.dc |
| 4+50 Pt11 | 554304.68 | 3664434.30 | 4.19 | LSC | 17thLONDON.dc |
| 4+50 Pt12 | 554304.30 | 3664439.71 | 0.57 | SLP | 17thLONDON.dc |
| 4+50 Pt13 | 554302.55 | 3664444.77 | -2.30 | E LIMESTONE GRAVEL | 17thLONDON.dc |
| 4+50 Pt14 | 554303.31 | 3664451.02 | -3.95 | LST | 17thLONDON.dc |
| 4+50 Pt15 | 554301.10 | 3664488.35 | -5.52 | NG | 17thLONDON.dc |
| 4+50 Pt16 | 554300.64 | 3664501.78 | -4.98 | TOP | 17thLONDON.dc |
| 4+50 Pt17 | 554299.39 | 3664508.51 | -6.26 | TOE | 17thLONDON.dc |
| 4+50 Pt18 | 554299.10 | 3664510.12 | -6.18 | E BLDG | 17thLONDON.dc |
| 4+50 Pt19 | 554300.15 | 3664553.69 | -5.75 | E BLDG | 17thLONDON.dc |
| 4+50 Pt20 | 554292.71 | 3664586.90 | -5.64 | NG | 17thLONDON.dc |
| 4+50 Pt21 | 554306.19 | 3664411.28 | 1.57 | TOP EDGE OF RIP RAP | 17thLONDON.dc |
| 4+50 Pt22 | 554290.72 | 3664616.05 | -6.00 | NG | 17thLONDON.dc |
| 4+50 Pt23 | 554288.81 | 3664637.51 | -5.95 | NG | 17thLONDON.dc |
| 4+50 Pt24 | 554288.00 | 3664654.64 | -5.52 | E ROAD | 17thLONDON.dc |
| 4+50 Pt25 | 554287.25 | 3664664.44 | -5.27 | CL ROAD | 17thLONDON.dc |
| 4+50 Pt26 | 554285.24 | 3664689.27 | -5.68 | ON ROAD | 17thLONDON.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 4+50 Pt27 | 554283.36 | 3664716.66 | -5.62 | ON ROAD | 17thLONDON.dc |
| 4+50 Pt28 | 554306.99 | 3664401.38 | 1.35 | TOP RIP RAP | 17thLONDON.dc |
| 4+50 Pt29 | 554307.11 | 3664398.15 | -0.78 | WES | 17thLONDON.dc |
| 4+50 Pt30 | 554305.82 | 3664412.64 | 12.37 | TOP CONC FLDWALL | 17thLONDON.dc |
| 4+50 Pt31 | 554305.78 | 3664413.38 | 12.38 | TOP CONC FLDWALL | 17thLONDON.dc |
| 4+50 Pt32 | 554305.38 | 3664414.12 | 5.20 | TOE CONC FLDWALL | 17thLONDON.dc |
| 4+50 Pt33 | 554305.30 | 3664416.43 | 5.10 | ON LEVEE | 17thLONDON.dc |
| 4+50 Pt34 | 554305.14 | 3664423.63 | 4.97 | C\L LEVEE | 17thLONDON.dc |
| | | | | | |
| 5+00 Pt01 | 554257.70 | 3664401.79 | -0.97 | SND | Book# 060856 |
| 5+00 Pt02 | 554258.44 | 3664391.81 | -3.37 | SND | Book# 060856 |
| 5+00 Pt03 | 554259.19 | 3664381.84 | -9.67 | SND | Book# 060856 |
| 5+00 Pt04 | 554259.94 | 3664371.87 | -11.77 | SND | Book# 060856 |
| 5+00 Pt05 | 554260.69 | 3664361.90 | -15.17 | SND | Book# 060856 |
| 5+00 Pt06 | 554261.44 | 3664351.93 | -14.87 | SND | Book# 060856 |
| 5+00 Pt07 | 554262.18 | 3664341.95 | -16.17 | SND | Book# 060856 |
| 5+00 Pt08 | 554262.93 | 3664331.98 | -17.47 | SND | Book# 060856 |
| 5+00 Pt09 | 554263.68 | 3664322.01 | -18.27 | SND | Book# 060856 |
| 5+00 Pt10 | 554263.68 | 3664322.01 | -18.27 | CL | Book# 060856 |
| 5+00 Pt11 | 554256.64 | 3664394.89 | -0.81 | WES | 17thLONDON.dc |
| 5+00 Pt12 | 554254.56 | 3664430.38 | 4.67 | LSC | 17thLONDON.dc |
| 5+00 Pt13 | 554236.03 | 3664708.16 | -4.87 | NG | 17thLONDON.dc |
| 5+00 Pt14 | 554236.74 | 3664699.12 | -5.63 | EDGE SIDEWALK | 17thLONDON.dc |
| 5+00 Pt15 | 554237.68 | 3664695.33 | -5.73 | EDGE SIDEWALK | 17thLONDON.dc |
| 5+00 Pt16 | 554239.89 | 3664670.93 | -5.85 | E ROAD | 17thLONDON.dc |
| 5+00 Pt17 | 554239.80 | 3664660.29 | -5.30 | CL ROAD | 17thLONDON.dc |
| 5+00 Pt18 | 554240.00 | 3664651.46 | -5.58 | E ROAD | 17thLONDON.dc |
| 5+00 Pt19 | 554241.14 | 3664619.40 | -4.93 | NG | 17thLONDON.dc |
| 5+00 Pt20 | 554242.72 | 3664587.51 | -4.59 | NG | 17thLONDON.dc |
| 5+00 Pt21 | 554246.29 | 3664555.38 | -5.76 | NG | 17thLONDON.dc |
| 5+00 Pt22 | 554257.04 | 3664400.31 | 1.09 | TOP RIP RAP | 17thLONDON.dc |
| 5+00 Pt23 | 554248.40 | 3664524.92 | -6.15 | NG | 17thLONDON.dc |
| 5+00 Pt24 | 554248.72 | 3664499.26 | -6.45 | NG | 17thLONDON.dc |
| 5+00 Pt25 | 554248.75 | 3664478.51 | -5.87 | NG | 17thLONDON.dc |
| 5+00 Pt26 | 554253.21 | 3664449.92 | -4.10 | LST | 17thLONDON.dc |
| 5+00 Pt27 | 554253.70 | 3664442.22 | -2.47 | E LIMESTONE GRAVEL | 17thLONDON.dc |
| 5+00 Pt28 | 554253.85 | 3664434.55 | 1.85 | SLP | 17thLONDON.dc |
| 5+00 Pt29 | 554256.48 | 3664407.86 | 1.51 | TOP EDGE OF RIP RAP | 17thLONDON.dc |
| 5+00 Pt30 | 554256.33 | 3664408.39 | 1.21 | TOE CONC FLDWALL | 17thLONDON.dc |
| 5+00 Pt31 | 554256.33 | 3664409.22 | 12.42 | TOP CONC FLDWALL | 17thLONDON.dc |
| 5+00 Pt32 | 554256.30 | 3664409.99 | 12.43 | TOP CONC FLDWALL | 17thLONDON.dc |
| 5+00 Pt33 | 554256.25 | 3664410.59 | 5.23 | TOE CONC FLDWALL | 17thLONDON.dc |
| 5+00 Pt34 | 554256.10 | 3664412.41 | 5.12 | ON LEVEE | 17thLONDON.dc |
| 5+00 Pt35 | 554255.43 | 3664420.92 | 5.07 | C\L LEVEE | 17thLONDON.dc |
| | | | | | |
| 5+50 Pt01 | 554208.58 | 3664388.07 | -5.57 | SND | Book# 060856 |
| 5+50 Pt02 | 554209.33 | 3664378.10 | -9.57 | SND | Book# 060856 |
| 5+50 Pt03 | 554210.08 | 3664368.13 | -12.37 | SND | Book# 060856 |
| 5+50 Pt04 | 554210.83 | 3664358.16 | -10.67 | SND | Book# 060856 |
| 5+50 Pt05 | 554211.58 | 3664348.19 | -12.17 | SND | Book# 060856 |
| 5+50 Pt06 | 554212.32 | 3664338.21 | -12.57 | SND | Book# 060856 |
| 5+50 Pt07 | 554213.07 | 3664328.24 | -17.07 | SND | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 5+50 Pt08 | 554213.82 | 3664318.27 | -17.57 | SND | Book# 060856 |
| 5+50 Pt09 | 554213.82 | 3664318.27 | -17.57 | CL | Book# 060856 |
| 5+50 Pt10 | 554204.73 | 3664428.27 | 4.39 | LSC | 17thLONDON.dc |
| 5+50 Pt11 | 554207.53 | 3664393.26 | -0.85 | WES | 17thLONDON.dc |
| 5+50 Pt12 | 554204.37 | 3664434.23 | 0.71 | SLP | 17thLONDON.dc |
| 5+50 Pt13 | 554203.76 | 3664440.09 | -2.63 | E LIMESTONE GRAVEL | 17thLONDON.dc |
| 5+50 Pt14 | 554203.85 | 3664441.09 | -2.80 | LST | 17thLONDON.dc |
| 5+50 Pt15 | 554201.76 | 3664463.77 | -3.63 | NG | 17thLONDON.dc |
| 5+50 Pt16 | 554200.23 | 3664487.39 | -4.13 | NG | 17thLONDON.dc |
| 5+50 Pt17 | 554198.70 | 3664510.20 | -4.54 | NG | 17thLONDON.dc |
| 5+50 Pt18 | 554197.95 | 3664522.39 | -4.33 | TOP | 17thLONDON.dc |
| 5+50 Pt19 | 554197.24 | 3664527.49 | -6.60 | TOE | 17thLONDON.dc |
| 5+50 Pt20 | 554197.02 | 3664533.58 | -6.96 | TOE | 17thLONDON.dc |
| 5+50 Pt21 | 554205.41 | 3664417.29 | 4.97 | C\L LEVEE | 17thLONDON.dc |
| 5+50 Pt22 | 554197.51 | 3664539.09 | -4.52 | TOP | 17thLONDON.dc |
| 5+50 Pt23 | 554194.85 | 3664567.75 | -4.00 | NG | 17thLONDON.dc |
| 5+50 Pt24 | 554192.44 | 3664591.82 | -5.05 | NG | 17thLONDON.dc |
| 5+50 Pt25 | 554190.90 | 3664608.64 | -5.13 | NG | 17thLONDON.dc |
| 5+50 Pt26 | 554190.38 | 3664629.83 | -5.65 | NG | 17thLONDON.dc |
| 5+50 Pt27 | 554188.78 | 3664647.16 | -5.80 | E ROAD | 17thLONDON.dc |
| 5+50 Pt28 | 554187.95 | 3664656.76 | -5.46 | CL ROAD | 17thLONDON.dc |
| 5+50 Pt29 | 554187.55 | 3664667.56 | -5.86 | E ROAD | 17thLONDON.dc |
| 5+50 Pt30 | 554186.61 | 3664680.62 | -5.76 | NG | 17thLONDON.dc |
| 5+50 Pt31 | 554185.85 | 3664691.78 | -5.86 | EDGE SIDEWALK | 17thLONDON.dc |
| 5+50 Pt32 | 554205.63 | 3664409.65 | 4.94 | ON LEVEE | 17thLONDON.dc |
| 5+50 Pt33 | 554184.45 | 3664695.45 | -5.81 | EDGE SIDEWALK | 17thLONDON.dc |
| 5+50 Pt34 | 554205.90 | 3664407.33 | 5.08 | TOE CONC FLDWALL | 17thLONDON.dc |
| 5+50 Pt35 | 554205.41 | 3664406.50 | 12.33 | TOP CONC FLDWALL | 17thLONDON.dc |
| 5+50 Pt36 | 554205.56 | 3664405.82 | 12.32 | TOP CONC FLDWALL | 17thLONDON.dc |
| 5+50 Pt37 | 554205.65 | 3664404.99 | 2.07 | TOE CONC FLDWALL | 17thLONDON.dc |
| 5+50 Pt38 | 554205.58 | 3664404.92 | 2.02 | TOP EDGE OF RIP RAP | 17thLONDON.dc |
| 5+50 Pt39 | 554207.78 | 3664395.24 | 1.26 | TOP RIP RAP | 17thLONDON.dc |
| | | | | | |
| 14+00 Pt01 | 553360.22 | 3664334.46 | -1.37 | SND | Book# 060856 |
| 14+00 Pt02 | 553360.96 | 3664324.48 | -4.87 | SND | Book# 060856 |
| 14+00 Pt03 | 553361.71 | 3664314.51 | -12.57 | SND | Book# 060856 |
| 14+00 Pt04 | 553362.46 | 3664304.54 | -14.57 | SND | Book# 060856 |
| 14+00 Pt05 | 553363.21 | 3664294.57 | -12.77 | SND | Book# 060856 |
| 14+00 Pt06 | 553363.96 | 3664284.60 | -10.47 | SND | Book# 060856 |
| 14+00 Pt07 | 553364.70 | 3664274.62 | -16.17 | SND | Book# 060856 |
| 14+00 Pt08 | 553365.45 | 3664264.65 | -15.17 | SND | Book# 060856 |
| 14+00 Pt09 | 553365.45 | 3664264.65 | -15.17 | CL | Book# 060856 |
| 14+00 Pt10 | 553355.82 | 3664365.99 | 2.43 | FL | 17thLONDON.dc |
| 14+00 Pt11 | 553357.78 | 3664332.18 | -0.72 | WES | 17thLONDON.dc |
| 14+00 Pt12 | 553355.13 | 3664375.99 | -0.46 | SLP | 17thLONDON.dc |
| 14+00 Pt13 | 553355.00 | 3664384.04 | -2.60 | LST | 17thLONDON.dc |
| 14+00 Pt14 | 553353.09 | 3664410.26 | -3.26 | NG | 17thLONDON.dc |
| 14+00 Pt15 | 553351.11 | 3664431.85 | -3.70 | E CONC DRIVEWAY | 17thLONDON.dc |
| 14+00 Pt16 | 553349.22 | 3664459.28 | -3.90 | ON CONC DRIVEWAY | 17thLONDON.dc |
| 14+00 Pt17 | 553347.84 | 3664476.87 | -4.10 | E BLDG | 17thLONDON.dc |
| 14+00 Pt18 | 553346.16 | 3664500.90 | -4.46 | E BLDG | 17thLONDON.dc |
| 14+00 Pt19 | 553345.13 | 3664510.79 | -4.92 | ON CONC DRIVEWAY | 17thLONDON.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 14+00 Pt20 | 553343.54 | 3664540.19 | -5.43 | E CONC DRIVEWAY | 17thLONDON.dc |
| 14+00 Pt21 | 553355.64 | 3664362.60 | 3.14 | LSC | 17thLONDON.dc |
| 14+00 Pt22 | 553340.86 | 3664565.89 | -6.02 | EDGE SIDEWALK | 17thLONDON.dc |
| 14+00 Pt23 | 553340.59 | 3664569.86 | -6.09 | EDGE SIDEWALK | 17thLONDON.dc |
| 14+00 Pt24 | 553339.32 | 3664587.10 | -6.68 | NG | 17thLONDON.dc |
| 14+00 Pt25 | 553338.48 | 3664598.12 | -7.05 | E ROAD | 17thLONDON.dc |
| 14+00 Pt26 | 553337.30 | 3664606.42 | -6.77 | CL ROAD | 17thLONDON.dc |
| 14+00 Pt27 | 553336.71 | 3664616.11 | -7.34 | E ROAD | 17thLONDON.dc |
| 14+00 Pt28 | 553335.20 | 3664634.89 | -7.48 | NG | 17thLONDON.dc |
| 14+00 Pt29 | 553356.50 | 3664355.24 | 3.72 | C\L LEVEE | 17thLONDON.dc |
| 14+00 Pt30 | 553356.85 | 3664349.18 | 4.15 | TOE CONC FLDWALL | 17thLONDON.dc |
| 14+00 Pt31 | 553357.14 | 3664348.77 | 12.41 | TOP CONC FLDWALL | 17thLONDON.dc |
| 14+00 Pt32 | 553357.13 | 3664348.05 | 12.36 | TOP CONC FLDWALL | 17thLONDON.dc |
| 14+00 Pt33 | 553357.73 | 3664347.24 | 1.84 | TOE CONC FLDWALL | 17thLONDON.dc |
| 14+00 Pt34 | 553357.78 | 3664347.34 | 1.82 | TOP EDGE OF RIP RAP | 17thLONDON.dc |
| 14+00 Pt35 | 553358.19 | 3664336.86 | 1.39 | TOP RIP RAP | 17thLONDON.dc |
| | | | | | |
| 14+50 Pt01 | 553310.22 | 3664337.66 | -3.97 | SND | Book# 060856 |
| 14+50 Pt02 | 553310.96 | 3664327.68 | -6.17 | SND | Book# 060856 |
| 14+50 Pt03 | 553311.71 | 3664317.71 | -10.57 | SND | Book# 060856 |
| 14+50 Pt04 | 553312.46 | 3664307.74 | -15.37 | SND | Book# 060856 |
| 14+50 Pt05 | 553313.21 | 3664297.77 | -16.37 | SND | Book# 060856 |
| 14+50 Pt06 | 553313.96 | 3664287.80 | -16.27 | SND | Book# 060856 |
| 14+50 Pt07 | 553314.70 | 3664277.82 | -18.47 | SND | Book# 060856 |
| 14+50 Pt08 | 553315.45 | 3664267.85 | -17.67 | SND | Book# 060856 |
| 14+50 Pt09 | 553315.45 | 3664267.85 | -17.67 | CL | Book# 060856 |
| 14+50 Pt10 | 553304.09 | 3664364.37 | 1.76 | FL | 17thLONDON.dc |
| 14+50 Pt11 | 553307.30 | 3664345.18 | 12.36 | TOP CONC FLDWALL | 17thLONDON.dc |
| 14+50 Pt12 | 553304.65 | 3664372.83 | -0.95 | SLP | 17thLONDON.dc |
| 14+50 Pt13 | 553303.25 | 3664382.75 | -3.41 | LST | 17thLONDON.dc |
| 14+50 Pt14 | 553301.34 | 3664405.05 | -3.97 | NG | 17thLONDON.dc |
| 14+50 Pt15 | 553300.41 | 3664428.16 | -4.45 | E BLDG | 17thLONDON.dc |
| 14+50 Pt16 | 553291.40 | 3664537.79 | -4.26 | E BLDG | 17thLONDON.dc |
| 14+50 Pt17 | 553290.39 | 3664563.10 | -5.62 | EDGE SIDEWALK | 17thLONDON.dc |
| 14+50 Pt18 | 553290.13 | 3664567.00 | -5.68 | EDGE SIDEWALK | 17thLONDON.dc |
| 14+50 Pt19 | 553286.89 | 3664585.37 | -6.57 | NG | 17thLONDON.dc |
| 14+50 Pt20 | 553287.28 | 3664596.03 | -6.79 | E ROAD | 17thLONDON.dc |
| 14+50 Pt21 | 553305.94 | 3664358.44 | 3.12 | LSC | 17thLONDON.dc |
| 14+50 Pt22 | 553285.33 | 3664602.54 | -6.62 | CL ROAD | 17thLONDON.dc |
| 14+50 Pt23 | 553306.32 | 3664352.98 | 3.70 | C\L LEVEE | 17thLONDON.dc |
| 14+50 Pt24 | 553307.04 | 3664346.04 | 4.39 | TOE CONC FLDWALL | 17thLONDON.dc |
| 14+50 Pt25 | 553307.32 | 3664345.33 | 12.39 | TOP CONC FLDWALL | 17thLONDON.dc |
| 14+50 Pt26 | 553307.28 | 3664344.67 | 12.41 | TOP CONC FLDWALL | 17thLONDON.dc |
| 14+50 Pt27 | 553308.32 | 3664337.41 | -0.78 | WES | 17thLONDON.dc |
| 14+50 Pt28 | 553307.20 | 3664343.86 | -0.89 | TOE CONC FLDWALL | 17thLONDON.dc |
| 14+50 Pt29 | 553307.38 | 3664344.60 | 12.39 | TOP CONC FLDWALL | 17thLONDON.dc |
| | | | | | |
| 15+00 Pt01 | 553258.57 | 3664362.79 | 0.03 | WES | Book# 060856 |
| 15+00 Pt02 | 553258.72 | 3664360.80 | -0.87 | SND | Book# 060856 |
| 15+00 Pt03 | 553259.47 | 3664350.83 | -1.27 | SND | Book# 060856 |
| 15+00 Pt04 | 553260.22 | 3664340.86 | -5.07 | SND | Book# 060856 |
| 15+00 Pt05 | 553260.96 | 3664330.88 | -8.97 | SND | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 15+00 Pt06 | 553261.71 | 3664320.91 | -10.57 | SND | Book# 060856 |
| 15+00 Pt07 | 553262.46 | 3664310.94 | -12.67 | SND | Book# 060856 |
| 15+00 Pt08 | 553263.21 | 3664300.97 | -18.27 | SND | Book# 060856 |
| 15+00 Pt09 | 553263.96 | 3664291.00 | -18.47 | SND | Book# 060856 |
| 15+00 Pt10 | 553264.70 | 3664281.02 | -18.17 | SND | Book# 060856 |
| 15+00 Pt11 | 553265.45 | 3664271.05 | -18.07 | CL | Book# 060856 |
| 15+00 Pt12 | 553255.05 | 3664361.23 | 1.89 | FL | 17thLONDON.dc |
| 15+00 Pt13 | 553255.95 | 3664388.93 | -3.66 | NG | 17thLONDON.dc |
| 15+00 Pt14 | 553253.89 | 3664394.66 | -3.76 | E CONC SLAB | 17thLONDON.dc |
| 15+00 Pt15 | 553252.84 | 3664403.94 | -3.54 | E CONC SLAB | 17thLONDON.dc |
| 15+00 Pt16 | 553251.10 | 3664409.93 | -4.04 | NG | 17thLONDON.dc |
| 15+00 Pt17 | 553250.52 | 3664423.38 | -3.58 | E BLDG | 17thLONDON.dc |
| 15+00 Pt18 | 553242.77 | 3664535.20 | -4.57 | E BLDG | 17thLONDON.dc |
| 15+00 Pt19 | 553242.69 | 3664547.45 | -4.94 | NG | 17thLONDON.dc |
| 15+00 Pt20 | 553240.83 | 3664560.53 | -5.75 | EDGE SIDEWALK | 17thLONDON.dc |
| 15+00 Pt21 | 553240.30 | 3664563.59 | -5.75 | EDGE SIDEWALK | 17thLONDON.dc |
| 15+00 Pt22 | 553238.23 | 3664592.28 | -6.69 | E ROAD | 17thLONDON.dc |
| 15+00 Pt23 | 553256.04 | 3664354.57 | 3.19 | LSC | 17thLONDON.dc |
| 15+00 Pt24 | 553237.82 | 3664599.93 | -6.57 | CL ROAD | 17thLONDON.dc |
| 15+00 Pt25 | 553237.32 | 3664609.91 | -7.13 | E ROAD | 17thLONDON.dc |
| 15+00 Pt26 | 553256.53 | 3664348.69 | 3.87 | C\L LEVEE | 17thLONDON.dc |
| 15+00 Pt27 | 553256.95 | 3664342.65 | 4.73 | TOE CONC FLDWALL | 17thLONDON.dc |
| 15+00 Pt28 | 553257.65 | 3664340.44 | -0.65 | TOE CONC FLDWALL | 17thLONDON.dc |
| 15+00 Pt29 | 553257.20 | 3664341.03 | 12.46 | TOE CONC FLDWALL | 17thLONDON.dc |
| 15+00 Pt30 | 553257.23 | 3664341.86 | 12.48 | TOE CONC FLDWALL | 17thLONDON.dc |
| 15+00 Pt31 | 553255.08 | 3664370.30 | -1.26 | SLP | 17thLONDON.dc |
| 15+00 Pt32 | 553254.79 | 3664379.49 | -3.58 | LST | 17thLONDON.dc |

# Appendix 19
# Topographic and Hydrographic Cross Section Data

## London Avenue Canal

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 6+00 Pt01 | 555623.39 | 3680423.96 | -13.57 | SND | Book# 060856 |
| 6+00 Pt02 | 555622.75 | 3680413.98 | -13.87 | SND | Book# 060856 |
| 6+00 Pt03 | 555622.11 | 3680404.00 | -13.77 | SND | Book# 060856 |
| 6+00 Pt04 | 555621.46 | 3680394.02 | -13.97 | SND | Book# 060856 |
| 6+00 Pt05 | 555620.82 | 3680384.04 | -12.77 | SND | Book# 060856 |
| 6+00 Pt06 | 555620.18 | 3680374.06 | -10.47 | SND | Book# 060856 |
| 6+00 Pt07 | 555619.54 | 3680364.08 | -5.47 | SND | Book# 060856 |
| 6+00 Pt08 | 555618.90 | 3680354.10 | -2.77 | SND | Book# 060856 |
| 6+00 Pt09 | 555623.39 | 3680423.96 | -13.57 | CL | Book# 060856 |
| 6+00 Pt10 | 555618.57 | 3680350.16 | -0.95 | WES | 17thLONDON.dc |
| 6+00 Pt11 | 555609.64 | 3680210.07 | 11.54 | LSC | 17thLONDON.dc |
| 6+00 Pt12 | 555609.40 | 3680204.67 | 7.78 | SLP | 17thLONDON.dc |
| 6+00 Pt13 | 555609.24 | 3680199.34 | 6.11 | SLP | 17thLONDON.dc |
| 6+00 Pt14 | 555607.91 | 3680180.70 | 0.70 | LST | 17thLONDON.dc |
| 6+00 Pt15 | 555606.89 | 3680165.98 | -0.01 | NG | 17thLONDON.dc |
| 6+00 Pt16 | 555605.90 | 3680159.36 | -0.76 | TOP | 17thLONDON.dc |
| 6+00 Pt17 | 555605.83 | 3680148.91 | -2.13 | TOE | 17thLONDON.dc |
| 6+00 Pt18 | 555603.95 | 3680124.15 | -2.97 | NG | 17thLONDON.dc |
| 6+00 Pt19 | 555603.30 | 3680117.33 | -3.12 | TOP OF CURB | 17thLONDON.dc |
| 6+00 Pt20 | 555603.33 | 3680116.59 | -3.45 | TOE OF CURB | 17thLONDON.dc |
| 6+00 Pt21 | 555618.45 | 3680339.83 | 2.69 | TBK | 17thLONDON.dc |
| 6+00 Pt22 | 555603.46 | 3680115.48 | -3.43 | E ROAD | 17thLONDON.dc |
| 6+00 Pt23 | 555602.59 | 3680098.58 | -2.92 | CL ROAD | 17thLONDON.dc |
| 6+00 Pt24 | 555601.32 | 3680082.95 | -3.51 | E ROAD | 17thLONDON.dc |
| 6+00 Pt25 | 555601.21 | 3680080.60 | -3.57 | TOE OF CURB | 17thLONDON.dc |
| 6+00 Pt26 | 555601.22 | 3680079.70 | -3.21 | TOP OF CURB | 17thLONDON.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 6+00 Pt27 | 555601.18 | 3680076.44 | -3.41 | EDGE SIDEWALK | 17thLONDON.dc |
| 6+00 Pt28 | 555601.10 | 3680071.67 | -3.50 | EDGE SIDEWALK | 17thLONDON.dc |
| 6+00 Pt29 | 555600.16 | 3680048.85 | -2.87 | NG | 17thLONDON.dc |
| 6+00 Pt30 | 555596.72 | 3680024.40 | -2.36 | NG | 17thLONDON.dc |
| 6+00 Pt31 | 555594.16 | 3679974.69 | -2.65 | NG | 17thLONDON.dc |
| 6+00 Pt32 | 555617.54 | 3680324.06 | 3.02 | NG | 17thLONDON.dc |
| 6+00 Pt33 | 555615.25 | 3680298.84 | 4.23 | NG | 17thLONDON.dc |
| 6+00 Pt34 | 555613.92 | 3680275.46 | 4.78 | NG | 17thLONDON.dc |
| 6+00 Pt35 | 555612.80 | 3680253.85 | 5.22 | FST | 17thLONDON.dc |
| 6+00 Pt36 | 555611.83 | 3680243.05 | 11.93 | FSC | 17thLONDON.dc |
| 6+00 Pt37 | 555610.61 | 3680227.28 | 12.08 | C\L LEVEE | 17thLONDON.dc |
| 6+00 Pt38 | 555610.82 | 3680224.17 | 12.12 | ON LEVEE | 17thLONDON.dc |
| | | | | | |
| 6+50 Pt01 | 555574.13 | 3680437.15 | -13.17 | SND | Book# 060856 |
| 6+50 Pt02 | 555573.49 | 3680427.17 | -13.57 | SND | Book# 060856 |
| 6+50 Pt03 | 555572.85 | 3680417.19 | -13.67 | SND | Book# 060856 |
| 6+50 Pt04 | 555572.21 | 3680407.21 | -14.27 | SND | Book# 060856 |
| 6+50 Pt05 | 555571.56 | 3680397.23 | -13.47 | SND | Book# 060856 |
| 6+50 Pt06 | 555570.92 | 3680387.25 | -12.67 | SND | Book# 060856 |
| 6+50 Pt07 | 555570.28 | 3680377.27 | -9.47 | SND | Book# 060856 |
| 6+50 Pt08 | 555569.64 | 3680367.29 | -5.37 | SND | Book# 060856 |
| 6+50 Pt09 | 555569.00 | 3680357.31 | -1.37 | SND | Book# 060856 |
| 6+50 Pt10 | 555574.13 | 3680437.15 | -13.17 | CL | Book# 060856 |
| 6+50 Pt11 | 555544.04 | 3679977.38 | -2.78 | NG | 17thLONDON.dc |
| 6+50 Pt12 | 555552.53 | 3680102.70 | -2.59 | CL ROAD | 17thLONDON.dc |
| 6+50 Pt13 | 555553.66 | 3680120.69 | -2.35 | TOE OF CURB | 17thLONDON.dc |
| 6+50 Pt14 | 555553.66 | 3680121.72 | -1.93 | TOP OF CURB | 17thLONDON.dc |
| 6+50 Pt15 | 555554.22 | 3680127.34 | -2.06 | NG | 17thLONDON.dc |
| 6+50 Pt16 | 555555.51 | 3680152.67 | -1.85 | NG | 17thLONDON.dc |
| 6+50 Pt17 | 555555.61 | 3680160.48 | -1.53 | TOE | 17thLONDON.dc |
| 6+50 Pt18 | 555557.28 | 3680174.17 | -0.23 | TOP | 17thLONDON.dc |
| 6+50 Pt19 | 555558.09 | 3680188.58 | 0.73 | LST | 17thLONDON.dc |
| 6+50 Pt20 | 555558.32 | 3680194.83 | 1.80 | SLP | 17thLONDON.dc |
| 6+50 Pt21 | 555559.88 | 3680203.10 | 2.86 | SLP | 17thLONDON.dc |
| 6+50 Pt22 | 555546.53 | 3680002.34 | -2.66 | NG | 17thLONDON.dc |
| 6+50 Pt23 | 555560.83 | 3680227.28 | 4.78 | SLP | 17thLONDON.dc |
| 6+50 Pt24 | 555562.12 | 3680247.64 | 7.23 | SLP | 17thLONDON.dc |
| 6+50 Pt25 | 555563.30 | 3680256.06 | 10.64 | LSC | 17thLONDON.dc |
| 6+50 Pt26 | 555563.83 | 3680275.16 | 10.82 | C\L LEVEE | 17thLONDON.dc |
| 6+50 Pt27 | 555564.03 | 3680278.46 | 10.61 | ON LEVEE | 17thLONDON.dc |
| 6+50 Pt28 | 555564.60 | 3680292.73 | 10.40 | FSC | 17thLONDON.dc |
| 6+50 Pt29 | 555566.58 | 3680302.61 | 7.77 | SLP | 17thLONDON.dc |
| 6+50 Pt30 | 555568.35 | 3680310.66 | 5.01 | SLP | 17thLONDON.dc |
| 6+50 Pt31 | 555566.25 | 3680316.62 | 4.26 | FST | 17thLONDON.dc |
| 6+50 Pt32 | 555567.29 | 3680327.18 | 3.31 | NG | 17thLONDON.dc |
| 6+50 Pt33 | 555548.29 | 3680027.68 | -2.82 | NG | 17thLONDON.dc |
| 6+50 Pt34 | 555568.55 | 3680346.78 | 2.79 | NG | 17thLONDON.dc |
| 6+50 Pt35 | 555568.51 | 3680351.97 | 0.51 | SLP | 17thLONDON.dc |
| 6+50 Pt36 | 555568.88 | 3680357.77 | -0.87 | WES | 17thLONDON.dc |
| 6+50 Pt37 | 555549.95 | 3680052.92 | -2.76 | NG | 17thLONDON.dc |
| 6+50 Pt38 | 555550.82 | 3680075.67 | -3.22 | EDGE SIDEWALK | 17thLONDON.dc |
| 6+50 Pt39 | 555551.52 | 3680080.55 | -3.09 | EDGE SIDEWALK | 17thLONDON.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 6+50 Pt40 | 555551.51 | 3680084.12 | -2.91 | TOP OF CURB | 17thLONDON.dc |
| 6+50 Pt41 | 555551.43 | 3680084.96 | -3.26 | TOE OF CURB | 17thLONDON.dc |
| 6+50 Pt42 | 555551.39 | 3680086.69 | -3.29 | E ROAD | 17thLONDON.dc |
| | | | | | |
| 7+00 Pt01 | 555524.24 | 3680440.37 | -13.16 | SND | Book# 060856 |
| 7+00 Pt02 | 555523.60 | 3680430.39 | -13.36 | SND | Book# 060856 |
| 7+00 Pt03 | 555522.96 | 3680420.41 | -13.56 | SND | Book# 060856 |
| 7+00 Pt04 | 555522.31 | 3680410.43 | -13.86 | SND | Book# 060856 |
| 7+00 Pt05 | 555521.67 | 3680400.45 | -13.76 | SND | Book# 060856 |
| 7+00 Pt06 | 555521.03 | 3680390.47 | -14.16 | SND | Book# 060856 |
| 7+00 Pt07 | 555520.39 | 3680380.49 | -10.76 | SND | Book# 060856 |
| 7+00 Pt08 | 555519.74 | 3680370.51 | -4.86 | SND | Book# 060856 |
| 7+00 Pt09 | 555524.24 | 3680440.37 | -13.16 | CL | Book# 060856 |
| 7+00 Pt10 | 555520.28 | 3680365.10 | -0.83 | WES | 17thLONDON.dc |
| 7+00 Pt11 | 555513.84 | 3680279.74 | 1.53 | LST | 17thLONDON.dc |
| 7+00 Pt12 | 555512.06 | 3680255.54 | 0.64 | NG | 17thLONDON.dc |
| 7+00 Pt13 | 555511.30 | 3680231.31 | 0.22 | NG | 17thLONDON.dc |
| 7+00 Pt14 | 555510.49 | 3680220.82 | -0.11 | TOE | 17thLONDON.dc |
| 7+00 Pt15 | 555509.76 | 3680206.19 | 0.61 | SLP | 17thLONDON.dc |
| 7+00 Pt16 | 555507.47 | 3680181.21 | 1.60 | TOP | 17thLONDON.dc |
| 7+00 Pt17 | 555506.29 | 3680155.50 | 0.85 | NG | 17thLONDON.dc |
| 7+00 Pt18 | 555505.79 | 3680150.37 | 0.73 | TOP OF CURB | 17thLONDON.dc |
| 7+00 Pt19 | 555505.53 | 3680149.76 | -0.02 | TOE OF CURB | 17thLONDON.dc |
| 7+00 Pt20 | 555504.81 | 3680148.65 | -0.07 | E ROAD | 17thLONDON.dc |
| 7+00 Pt21 | 555519.77 | 3680356.40 | 2.90 | TBK | 17thLONDON.dc |
| 7+00 Pt22 | 555505.04 | 3680140.10 | -0.30 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt23 | 555504.21 | 3680130.72 | -0.71 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt24 | 555502.72 | 3680106.99 | -1.68 | CL ROAD | 17thLONDON.dc |
| 7+00 Pt25 | 555501.45 | 3680080.77 | -2.56 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt26 | 555499.75 | 3680069.06 | -2.78 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt27 | 555499.76 | 3680055.91 | -2.78 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt28 | 555497.68 | 3680032.11 | -3.01 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt29 | 555496.73 | 3680006.01 | -3.02 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt30 | 555494.47 | 3679980.48 | -2.91 | ON ROAD | 17thLONDON.dc |
| 7+00 Pt31 | 555518.03 | 3680341.41 | 3.22 | FST | 17thLONDON.dc |
| 7+00 Pt32 | 555518.97 | 3680334.93 | 3.97 | SLP | 17thLONDON.dc |
| 7+00 Pt33 | 555516.60 | 3680317.41 | 8.73 | FSC | 17thLONDON.dc |
| 7+00 Pt34 | 555515.67 | 3680306.42 | 8.40 | C\L LEVEE | 17thLONDON.dc |
| 7+00 Pt35 | 555514.99 | 3680294.66 | 8.15 | LSC | 17thLONDON.dc |
| 7+00 Pt36 | 555517.18 | 3680324.80 | 7.18 | SLP | 17thLONDON.dc |
| 7+00 Pt37 | 555513.52 | 3680285.86 | 2.86 | SLP | 17thLONDON.dc |
| | | | | | |
| 15+50 Pt01 | 554669.76 | 3680398.17 | 4.29 | TEF | Book# 060856 |
| 15+50 Pt02 | 554669.12 | 3680388.19 | 4.19 | CL | Book# 060856 |
| 15+50 Pt03 | 554668.93 | 3680385.20 | 4.09 | TOP | Book# 060856 |
| 15+50 Pt04 | 554668.03 | 3680371.22 | 3.29 | TOP | Book# 060856 |
| 15+50 Pt05 | 554667.71 | 3680366.24 | -0.11 | FL | Book# 060856 |
| 15+50 Pt06 | 554667.64 | 3680365.24 | -2.51 | ERK | Book# 060856 |
| 15+50 Pt07 | 554667.32 | 3680360.25 | -3.61 | NG | Book# 060856 |
| 15+50 Pt08 | 554665.72 | 3680335.30 | -4.21 | NG | Book# 060856 |
| 15+50 Pt09 | 554664.62 | 3680318.33 | -4.41 | BLD | Book# 060856 |
| 15+50 Pt10 | 554664.24 | 3680312.35 | -4.59 | BLD | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 15+50 Pt11 | 554659.29 | 3680235.51 | -5.59 | NG | Book# 060856 |
| 15+50 Pt12 | 554658.65 | 3680225.53 | -5.49 | ES | Book# 060856 |
| 15+50 Pt13 | 554658.39 | 3680221.53 | -5.49 | ES | Book# 060856 |
| 15+50 Pt14 | 554658.26 | 3680219.54 | -4.79 | TOP | Book# 060856 |
| 15+50 Pt15 | 554657.69 | 3680210.56 | -4.89 | TOP | Book# 060856 |
| 15+50 Pt16 | 554657.49 | 3680207.56 | -5.59 | TPC | Book# 060856 |
| 15+50 Pt17 | 554657.43 | 3680206.57 | -5.99 | TPC | Book# 060856 |
| 15+50 Pt18 | 554656.66 | 3680194.59 | -5.79 | CLR | Book# 060856 |
| 15+50 Pt19 | 554655.82 | 3680181.62 | -6.29 | TEC | Book# 060856 |
| 15+50 Pt20 | 554655.76 | 3680180.62 | -5.89 | TPC | Book# 060856 |
| 15+50 Pt21 | 554654.47 | 3680160.66 | -5.39 | NG | Book# 060856 |
| 15+50 Pt22 | 554657.43 | 3680206.57 | -5.99 | ER | Book# 060856 |
| 15+50 Pt23 | 554655.82 | 3680181.62 | -6.29 | ER | Book# 060856 |
| 15+50 Pt24 | 554674.71 | 3680475.01 | -12.86 | SND | Book# 060856 |
| 15+50 Pt25 | 554674.07 | 3680465.03 | -12.76 | SND | Book# 060856 |
| 15+50 Pt26 | 554673.42 | 3680455.05 | -12.86 | SND | Book# 060856 |
| 15+50 Pt27 | 554672.78 | 3680445.07 | -6.86 | SND | Book# 060856 |
| 15+50 Pt28 | 554672.14 | 3680435.09 | -3.46 | SND | Book# 060856 |
| 15+50 Pt29 | 554671.50 | 3680425.11 | -1.46 | SND | Book# 060856 |
| 15+50 Pt30 | 554674.71 | 3680475.01 | -12.86 | CL | Book# 060856 |
| 15+50 Pt31 | 554670.59 | 3680424.16 | -0.96 | WES | 17thLONDON.dc |
| 15+50 Pt32 | 554670.03 | 3680415.28 | 1.65 | TBK | 17thLONDON.dc |
| 15+50 Pt33 | 554669.54 | 3680410.62 | 2.44 | NG | 17thLONDON.dc |
| 15+50 Pt34 | 554668.50 | 3680400.32 | 3.12 | TOE CONC FLDWALL | 17thLONDON.dc |
| 15+50 Pt35 | 554667.93 | 3680399.87 | 13.04 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| 15+50 Pt36 | 554667.96 | 3680399.17 | 13.11 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| | | | | | |
| 16+00 Pt01 | 554619.93 | 3680402.38 | 4.28 | TEF | Book# 060856 |
| 16+00 Pt02 | 554619.42 | 3680394.39 | 3.88 | CL | Book# 060856 |
| 16+00 Pt03 | 554619.03 | 3680388.41 | 3.78 | RD | Book# 060856 |
| 16+00 Pt04 | 554618.33 | 3680377.43 | 3.18 | TOP | Book# 060856 |
| 16+00 Pt05 | 554617.88 | 3680370.44 | -1.12 | FL | Book# 060856 |
| 16+00 Pt06 | 554617.81 | 3680369.45 | -2.92 | TOE | Book# 060856 |
| 16+00 Pt07 | 554617.43 | 3680363.46 | -3.42 | NG | Book# 060856 |
| 16+00 Pt08 | 554616.33 | 3680346.49 | -3.72 | EC | Book# 060856 |
| 16+00 Pt09 | 554616.01 | 3680341.50 | -3.22 | TOP | Book# 060856 |
| 16+00 Pt10 | 554616.01 | 3680341.50 | -8.82 | TOE | Book# 060856 |
| 16+00 Pt11 | 554614.34 | 3680315.56 | -7.02 | TOE | Book# 060856 |
| 16+00 Pt12 | 554614.09 | 3680311.57 | -3.22 | TOP | Book# 060856 |
| 16+00 Pt13 | 554614.02 | 3680310.57 | -3.22 | TOP | Book# 060856 |
| 16+00 Pt14 | 554614.02 | 3680310.57 | -4.22 | TOE | Book# 060856 |
| 16+00 Pt15 | 554613.76 | 3680306.58 | -4.22 | BLD | Book# 060856 |
| 16+00 Pt16 | 554610.49 | 3680255.68 | -4.59 | BLD | Book# 060856 |
| 16+00 Pt17 | 554610.17 | 3680250.69 | -4.79 | TOP | Book# 060856 |
| 16+00 Pt18 | 554609.97 | 3680247.70 | -5.29 | TOE | Book# 060856 |
| 16+00 Pt19 | 554609.39 | 3680238.72 | -5.69 | NG | Book# 060856 |
| 16+00 Pt20 | 554608.75 | 3680228.74 | -5.69 | ES | Book# 060856 |
| 16+00 Pt21 | 554608.50 | 3680224.75 | -5.69 | ES | Book# 060856 |
| 16+00 Pt22 | 554607.66 | 3680211.77 | -5.79 | TPC | Book# 060856 |
| 16+00 Pt23 | 554607.60 | 3680210.77 | -6.19 | TEC | Book# 060856 |
| 16+00 Pt24 | 554606.76 | 3680197.80 | -6.09 | CLR | Book# 060856 |
| 16+00 Pt25 | 554605.93 | 3680184.83 | -6.19 | TEC | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 16+00 Pt26 | 554605.86 | 3680183.83 | -5.89 | TPC | Book# 060856 |
| 16+00 Pt27 | 554604.58 | 3680163.87 | -5.29 | NG | Book# 060856 |
| 16+00 Pt28 | 554625.46 | 3680488.20 | -12.26 | SND | Book# 060856 |
| 16+00 Pt29 | 554624.81 | 3680478.22 | -12.26 | SND | Book# 060856 |
| 16+00 Pt30 | 554624.17 | 3680468.24 | -12.46 | SND | Book# 060856 |
| 16+00 Pt31 | 554623.53 | 3680458.26 | -12.66 | SND | Book# 060856 |
| 16+00 Pt32 | 554622.89 | 3680448.28 | -5.26 | SND | Book# 060856 |
| 16+00 Pt33 | 554622.24 | 3680438.30 | -3.46 | SND | Book# 060856 |
| 16+00 Pt34 | 554621.60 | 3680428.32 | -1.16 | SND | Book# 060856 |
| 16+00 Pt35 | 554625.46 | 3680488.20 | -12.26 | CL | Book# 060856 |
| 16+00 Pt36 | 554619.52 | 3680428.70 | -0.92 | WES | 17thLONDON.dc |
| 16+00 Pt37 | 554618.84 | 3680420.75 | 1.10 | TOP | 17thLONDON.dc |
| 16+00 Pt38 | 554620.89 | 3680412.46 | 1.79 | TOE | 17thLONDON.dc |
| 16+00 Pt39 | 554620.75 | 3680409.01 | 2.95 | TBK | 17thLONDON.dc |
| 16+00 Pt40 | 554619.14 | 3680404.50 | 2.94 | TOE CONC FLDWALL | 17thLONDON.dc |
| 16+00 Pt41 | 554618.86 | 3680403.85 | 13.01 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| 16+00 Pt42 | 554618.87 | 3680403.40 | 13.01 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| | | | | | |
| 16+50 Pt01 | 554570.10 | 3680406.60 | 4.38 | TEF | Book# 060856 |
| 16+50 Pt02 | 554569.52 | 3680397.61 | 3.88 | CL | Book# 060856 |
| 16+50 Pt03 | 554569.14 | 3680391.63 | 3.78 | TLV | Book# 060856 |
| 16+50 Pt04 | 554568.88 | 3680387.63 | 3.68 | SLP | Book# 060856 |
| 16+50 Pt05 | 554568.37 | 3680379.65 | -2.62 | TOE | Book# 060856 |
| 16+50 Pt06 | 554568.11 | 3680375.66 | -2.82 | FL | Book# 060856 |
| 16+50 Pt07 | 554567.53 | 3680366.68 | -3.52 | NG | Book# 060856 |
| 16+50 Pt08 | 554566.12 | 3680344.72 | -4.72 | BLD | Book# 060856 |
| 16+50 Pt09 | 554561.94 | 3680279.86 | -4.69 | BLD | Book# 060856 |
| 16+50 Pt10 | 554561.11 | 3680266.88 | -5.19 | TC | Book# 060856 |
| 16+50 Pt11 | 554560.14 | 3680251.92 | -5.69 | TC | Book# 060856 |
| 16+50 Pt12 | 554559.50 | 3680241.94 | -5.79 | TC | Book# 060856 |
| 16+50 Pt13 | 554557.90 | 3680216.99 | -5.69 | TEC | Book# 060856 |
| 16+50 Pt14 | 554557.83 | 3680215.99 | -6.09 | TPC | Book# 060856 |
| 16+50 Pt15 | 554556.93 | 3680202.02 | -5.79 | CLR | Book# 060856 |
| 16+50 Pt16 | 554556.10 | 3680189.05 | -6.09 | TEC | Book# 060856 |
| 16+50 Pt17 | 554556.03 | 3680188.05 | -5.79 | TPC | Book# 060856 |
| 16+50 Pt18 | 554554.68 | 3680167.09 | -5.19 | NG | Book# 060856 |
| 16+50 Pt19 | 554575.56 | 3680491.42 | -12.36 | SND | Book# 060856 |
| 16+50 Pt20 | 554574.92 | 3680481.44 | -12.06 | SND | Book# 060856 |
| 16+50 Pt21 | 554574.28 | 3680471.46 | -11.96 | SND | Book# 060856 |
| 16+50 Pt22 | 554573.63 | 3680461.48 | -12.06 | SND | Book# 060856 |
| 16+50 Pt23 | 554572.99 | 3680451.50 | -5.26 | SND | Book# 060856 |
| 16+50 Pt24 | 554572.35 | 3680441.52 | -3.26 | SND | Book# 060856 |
| 16+50 Pt25 | 554571.71 | 3680431.54 | -1.76 | SND | Book# 060856 |
| 16+50 Pt26 | 554575.56 | 3680491.42 | -12.36 | CL | Book# 060856 |
| 16+50 Pt27 | 554569.65 | 3680407.23 | 13.00 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| 16+50 Pt28 | 554569.66 | 3680407.72 | 13.03 | TOP EDGE CONC FLDWAL | 17thLONDON.dc |
| 16+50 Pt29 | 554569.58 | 3680408.32 | 3.21 | TOE CONC FLDWALL | 17thLONDON.dc |
| 16+50 Pt30 | 554569.79 | 3680413.36 | 3.10 | TBK | 17thLONDON.dc |
| 16+50 Pt31 | 554570.57 | 3680417.10 | 1.61 | TOE | 17thLONDON.dc |
| 16+50 Pt32 | 554571.39 | 3680422.65 | 1.03 | TOP | 17thLONDON.dc |
| 16+50 Pt33 | 554572.17 | 3680429.83 | -0.92 | WES | 17thLONDON.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 51+00 Pt01 | 551161.60 | 3681162.12 | -5.82 | NG | Book# 060856 |
| 51+00 Pt02 | 551158.39 | 3681112.22 | -5.62 | NG | Book# 060856 |
| 51+00 Pt03 | 551156.91 | 3681089.27 | -6.02 | ER | Book# 060856 |
| 51+00 Pt04 | 551156.27 | 3681079.29 | -5.82 | CLR | Book# 060856 |
| 51+00 Pt05 | 551155.50 | 3681067.32 | -6.22 | ER | Book# 060856 |
| 51+00 Pt06 | 551155.43 | 3681066.32 | -5.92 | PL | Book# 060856 |
| 51+00 Pt07 | 551155.17 | 3681062.33 | -4.72 | SLP | Book# 060856 |
| 51+00 Pt08 | 551153.76 | 3681040.37 | -1.52 | TOP | Book# 060856 |
| 51+00 Pt09 | 551152.60 | 3681022.41 | -0.72 | TOP | Book# 060856 |
| 51+00 Pt10 | 551151.83 | 3681010.43 | -2.22 | BLD | Book# 060856 |
| 51+00 Pt11 | 551151.38 | 3681003.45 | -2.82 | BLD | Book# 060856 |
| 51+00 Pt12 | 551156.91 | 3681089.27 | -6.02 | SD | Book# 060856 |
| 51+00 Pt13 | 551156.27 | 3681079.29 | -5.82 | SD | Book# 060856 |
| 51+00 Pt14 | 551155.50 | 3681067.32 | -6.22 | SD | Book# 060856 |
| 51+00 Pt15 | 551155.43 | 3681066.32 | -5.92 | TOE | Book# 060856 |
| 51+00 Pt16 | 551152.60 | 3681022.41 | -0.72 | SD | Book# 060856 |
| 51+00 Pt17 | 551151.83 | 3681010.43 | -2.22 | SD | Book# 060856 |
| 51+00 Pt18 | 551151.38 | 3681003.45 | -2.82 | SD | Book# 060856 |
| 51+00 Pt19 | 551149.59 | 3680975.51 | -2.37 | BLD | Book# 060856 |
| 51+00 Pt20 | 551149.14 | 3680968.52 | -0.77 | TOP | Book# 060856 |
| 51+00 Pt21 | 551148.75 | 3680962.53 | -1.67 | NG | Book# 060856 |
| 51+00 Pt22 | 551146.31 | 3680924.61 | 0.23 | TOP | Book# 060856 |
| 51+00 Pt23 | 551145.54 | 3680912.64 | -2.77 | TOE | Book# 060856 |
| 51+00 Pt24 | 551144.19 | 3680891.68 | -3.67 | TOE | Book# 060856 |
| 51+00 Pt25 | 551143.55 | 3680881.70 | -1.37 | TOP | Book# 060856 |
| 51+00 Pt26 | 551142.32 | 3680862.74 | -2.67 | NG | Book# 060856 |
| 51+00 Pt27 | 551142.00 | 3680857.75 | -3.07 | FST | Book# 060856 |
| 51+00 Pt28 | 551141.36 | 3680847.77 | 0.23 | SLP | Book# 060856 |
| 51+00 Pt29 | 551140.65 | 3680836.79 | 3.53 | LSC | Book# 060856 |
| 51+00 Pt30 | 551140.46 | 3680833.80 | 3.53 | TEF | Book# 060856 |
| 51+00 Pt31 | 551140.46 | 3680833.80 | 12.91 | TPF | Book# 060856 |
| 51+00 Pt32 | 551140.40 | 3680832.80 | 12.89 | TPF | Book# 060856 |
| 51+00 Pt33 | 551140.33 | 3680831.80 | 3.11 | TEF | Book# 060856 |
| 51+00 Pt34 | 551140.14 | 3680828.81 | 3.11 | TBK | Book# 060856 |
| 51+00 Pt35 | 551139.75 | 3680822.82 | 0.91 | TOP | Book# 060856 |
| 51+00 Pt36 | 551139.50 | 3680818.83 | -0.89 | WES | Book# 060856 |
| 51+00 Pt37 | 551133.46 | 3680725.02 | -0.89 | WES | Book# 060856 |
| 51+00 Pt38 | 551133.07 | 3680719.04 | 2.61 | TBK | Book# 060856 |
| 51+00 Pt39 | 551132.49 | 3680710.06 | 3.31 | TEF | Book# 060856 |
| 51+00 Pt40 | 551132.49 | 3680710.06 | 12.86 | TPF | Book# 060856 |
| 51+00 Pt41 | 551132.43 | 3680709.06 | 12.86 | TPF | Book# 060856 |
| 51+00 Pt42 | 551132.37 | 3680708.06 | 8.01 | TEF | Book# 060856 |
| 51+00 Pt43 | 551131.79 | 3680699.08 | 7.71 | CLR | Book# 060856 |
| 51+00 Pt44 | 551130.95 | 3680686.11 | 7.41 | TOP | Book# 060856 |
| 51+00 Pt45 | 551130.63 | 3680681.12 | 1.51 | TER | Book# 060856 |
| 51+00 Pt46 | 551130.25 | 3680675.13 | 0.71 | FL | Book# 060856 |
| 51+00 Pt47 | 551130.18 | 3680674.13 | -0.09 | TOE | Book# 060856 |
| 51+00 Pt48 | 551129.47 | 3680663.15 | -0.99 | NG | Book# 060856 |
| 51+00 Pt49 | 551126.26 | 3680613.26 | -0.89 | NG | Book# 060856 |
| 51+00 Pt50 | 551123.05 | 3680563.36 | -0.89 | NG | Book# 060856 |
| 51+00 Pt51 | 551119.84 | 3680513.46 | -1.39 | NG | Book# 060856 |
| 51+00 Pt52 | 551118.94 | 3680499.49 | -0.69 | FL | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 51+00 Pt53 | 551118.30 | 3680489.51 | -5.01 | PL | Book# 060856 |
| 51+00 Pt54 | 551117.78 | 3680481.53 | -5.51 | ER | Book# 060856 |
| 51+00 Pt55 | 551116.88 | 3680467.56 | -4.81 | CLR | Book# 060856 |
| 51+00 Pt56 | 551116.62 | 3680463.57 | -4.81 | RD | Book# 060856 |
| 51+00 Pt57 | 551116.05 | 3680454.58 | -5.31 | ER | Book# 060856 |
| 51+00 Pt58 | 551115.98 | 3680453.59 | -4.76 | TPC | Book# 060856 |
| 51+00 Pt59 | 551115.08 | 3680439.62 | -5.11 | SWK | Book# 060856 |
| 51+00 Pt60 | 551113.41 | 3680413.67 | -5.71 | NG | Book# 060856 |
| 51+00 Pt61 | 551112.13 | 3680393.71 | -5.21 | NG | Book# 060856 |
| 51+00 Pt62 | 551115.98 | 3680453.59 | -4.76 | SWK | Book# 060856 |
| 51+00 Pt63 | 551149.14 | 3680968.52 | -0.77 | SD | Book# 060856 |
| 51+00 Pt64 | 551148.75 | 3680962.53 | -1.67 | SD | Book# 060856 |
| 51+00 Pt65 | 551146.31 | 3680924.61 | 0.23 | SD | Book# 060856 |
| 51+00 Pt66 | 551145.54 | 3680912.64 | -2.77 | SD | Book# 060856 |
| 51+00 Pt67 | 551144.19 | 3680891.68 | -3.67 | SD | Book# 060856 |
| 51+00 Pt68 | 551143.55 | 3680881.70 | -1.37 | SD | Book# 060856 |
| 51+00 Pt69 | 551142.32 | 3680862.74 | -2.67 | SD | Book# 060856 |
| 51+00 Pt70 | 551142.00 | 3680857.75 | -3.07 | SD | Book# 060856 |
| 51+00 Pt71 | 551141.36 | 3680847.77 | 0.23 | SD | Book# 060856 |
| 51+00 Pt72 | 551139.11 | 3680812.84 | -6.30 | SND | Book# 060856 |
| 51+00 Pt73 | 551138.47 | 3680802.86 | -10.10 | SND | Book# 060856 |
| 51+00 Pt74 | 551137.83 | 3680792.88 | -12.00 | SND | Book# 060856 |
| 51+00 Pt75 | 551137.18 | 3680782.91 | -11.30 | SND | Book# 060856 |
| 51+00 Pt76 | 551136.54 | 3680772.93 | -11.10 | CL | Book# 060856 |
| | | | | | |
| 51+50 Pt01 | 551111.70 | 3681165.33 | -2.52 | NG | Book# 060856 |
| 51+50 Pt02 | 551108.49 | 3681115.43 | -5.02 | NG | Book# 060856 |
| 51+50 Pt03 | 551107.01 | 3681092.48 | -6.12 | ER | Book# 060856 |
| 51+50 Pt04 | 551106.30 | 3681081.50 | -6.12 | CLR | Book# 060856 |
| 51+50 Pt05 | 551105.66 | 3681071.52 | -6.02 | ER | Book# 060856 |
| 51+50 Pt06 | 551105.28 | 3681065.54 | -0.52 | PL | Book# 060856 |
| 51+50 Pt07 | 551105.08 | 3681062.54 | -2.72 | TOE | Book# 060856 |
| 51+50 Pt08 | 551104.12 | 3681047.57 | -1.72 | TOP | Book# 060856 |
| 51+50 Pt09 | 551103.22 | 3681033.60 | -3.02 | TOE | Book# 060856 |
| 51+50 Pt10 | 551102.19 | 3681017.64 | -2.42 | BLD | Book# 060856 |
| 51+50 Pt11 | 551111.70 | 3681165.33 | -2.52 | SD | Book# 060856 |
| 51+50 Pt12 | 551108.49 | 3681115.43 | -5.02 | SD | Book# 060856 |
| 51+50 Pt13 | 551107.01 | 3681092.48 | -6.12 | SD | Book# 060856 |
| 51+50 Pt14 | 551106.30 | 3681081.50 | -6.12 | SD | Book# 060856 |
| 51+50 Pt15 | 551105.66 | 3681071.52 | -6.02 | SD | Book# 060856 |
| 51+50 Pt16 | 551105.28 | 3681065.54 | -0.52 | SD | Book# 060856 |
| 51+50 Pt17 | 551105.08 | 3681062.54 | -2.72 | SD | Book# 060856 |
| 51+50 Pt18 | 551104.12 | 3681047.57 | -1.72 | SD | Book# 060856 |
| 51+50 Pt19 | 551103.22 | 3681033.60 | -3.02 | SD | Book# 060856 |
| 51+50 Pt20 | 551099.56 | 3680976.72 | -4.34 | BLD | Book# 060856 |
| 51+50 Pt21 | 551098.85 | 3680965.74 | -4.44 | TOE | Book# 060856 |
| 51+50 Pt22 | 551098.47 | 3680959.76 | -4.54 | TOE | Book# 060856 |
| 51+50 Pt23 | 551097.89 | 3680950.77 | -1.84 | TOP | Book# 060856 |
| 51+50 Pt24 | 551097.57 | 3680945.78 | -3.64 | TOE | Book# 060856 |
| 51+50 Pt25 | 551097.05 | 3680937.80 | -3.64 | TOE | Book# 060856 |
| 51+50 Pt26 | 551096.54 | 3680929.82 | -0.54 | TOP | Book# 060856 |
| 51+50 Pt27 | 551095.83 | 3680918.84 | -4.34 | TOE | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 51+50 Pt28 | 551095.25 | 3680909.86 | -4.14 | TOE | Book# 060856 |
| 51+50 Pt29 | 551094.42 | 3680896.89 | -0.64 | TOP | Book# 060856 |
| 51+50 Pt30 | 551093.65 | 3680884.91 | -2.84 | TOE | Book# 060856 |
| 51+50 Pt31 | 551093.20 | 3680877.92 | -3.34 | TOE | Book# 060856 |
| 51+50 Pt32 | 551093.01 | 3680874.93 | -1.14 | TOP | Book# 060856 |
| 51+50 Pt33 | 551092.43 | 3680865.95 | -1.84 | NG | Book# 060856 |
| 51+50 Pt34 | 551092.17 | 3680861.96 | -1.44 | FST | Book# 060856 |
| 51+50 Pt35 | 551091.46 | 3680850.98 | 0.06 | SLP | Book# 060856 |
| 51+50 Pt36 | 551090.82 | 3680841.00 | 3.26 | LSC | Book# 060856 |
| 51+50 Pt37 | 551090.63 | 3680838.01 | 3.36 | TEF | Book# 060856 |
| 51+50 Pt38 | 551090.63 | 3680838.01 | 12.88 | TPF | Book# 060856 |
| 51+50 Pt39 | 551098.85 | 3680965.74 | -4.44 | SD | Book# 060856 |
| 51+50 Pt40 | 551098.47 | 3680959.76 | -4.54 | SD | Book# 060856 |
| 51+50 Pt41 | 551097.89 | 3680950.77 | -1.84 | SD | Book# 060856 |
| 51+50 Pt42 | 551097.57 | 3680945.78 | -3.64 | SD | Book# 060856 |
| 51+50 Pt43 | 551097.05 | 3680937.80 | -3.64 | SD | Book# 060856 |
| 51+50 Pt44 | 551096.54 | 3680929.82 | -0.54 | SD | Book# 060856 |
| 51+50 Pt45 | 551095.83 | 3680918.84 | -4.34 | SD | Book# 060856 |
| 51+50 Pt46 | 551095.25 | 3680909.86 | -4.14 | SD | Book# 060856 |
| 51+50 Pt47 | 551094.42 | 3680896.89 | -0.64 | SD | Book# 060856 |
| 51+50 Pt48 | 551093.65 | 3680884.91 | -2.84 | SD | Book# 060856 |
| 51+50 Pt49 | 551093.20 | 3680877.92 | -3.34 | SD | Book# 060856 |
| 51+50 Pt50 | 551093.01 | 3680874.93 | -1.14 | SD | Book# 060856 |
| 51+50 Pt51 | 551092.43 | 3680865.95 | -1.84 | SD | Book# 060856 |
| 51+50 Pt52 | 551092.17 | 3680861.96 | -1.44 | SD | Book# 060856 |
| 51+50 Pt53 | 551090.56 | 3680837.01 | 12.87 | TPF | Book# 060856 |
| 51+50 Pt54 | 551090.50 | 3680836.01 | 3.11 | TEF | Book# 060856 |
| 51+50 Pt55 | 551090.31 | 3680833.02 | 3.11 | TBK | Book# 060856 |
| 51+50 Pt56 | 551089.73 | 3680824.04 | 0.81 | TOP | Book# 060856 |
| 51+50 Pt57 | 551089.54 | 3680821.04 | -0.89 | WES | Book# 060856 |
| 51+50 Pt58 | 551083.31 | 3680724.24 | -0.89 | WES | Book# 060856 |
| 51+50 Pt59 | 551083.24 | 3680723.25 | 2.41 | TBK | Book# 060856 |
| 51+50 Pt60 | 551082.53 | 3680712.27 | 3.21 | TEF | Book# 060856 |
| 51+50 Pt61 | 551082.53 | 3680712.27 | 12.86 | TPF | Book# 060856 |
| 51+50 Pt62 | 551082.47 | 3680711.27 | 12.87 | TPF | Book# 060856 |
| 51+50 Pt63 | 551082.41 | 3680710.27 | 3.94 | TEF | Book# 060856 |
| 51+50 Pt64 | 551081.96 | 3680703.29 | 3.44 | CLR | Book# 060856 |
| 51+50 Pt65 | 551081.57 | 3680697.30 | 3.04 | TRK | Book# 060856 |
| 51+50 Pt66 | 551080.86 | 3680686.32 | -2.16 | TOE | Book# 060856 |
| 51+50 Pt67 | 551080.48 | 3680680.33 | -3.06 | FL | Book# 060856 |
| 51+50 Pt68 | 551080.22 | 3680676.34 | -4.46 | TOE | Book# 060856 |
| 51+50 Pt69 | 551079.58 | 3680666.36 | -4.76 | NG | Book# 060856 |
| 51+50 Pt70 | 551076.37 | 3680616.47 | -4.96 | NG | Book# 060856 |
| 51+50 Pt71 | 551073.16 | 3680566.57 | -4.96 | NG | Book# 060856 |
| 51+50 Pt72 | 551069.94 | 3680516.67 | -5.56 | NG | Book# 060856 |
| 51+50 Pt73 | 551069.11 | 3680503.70 | -5.16 | FL | Book# 060856 |
| 51+50 Pt74 | 551068.92 | 3680500.71 | -5.46 | ES | Book# 060856 |
| 51+50 Pt75 | 551068.66 | 3680496.71 | -5.36 | ES | Book# 060856 |
| 51+50 Pt76 | 551068.02 | 3680486.73 | -5.26 | TPC | Book# 060856 |
| 51+50 Pt77 | 551067.95 | 3680485.74 | -5.66 | ER | Book# 060856 |
| 51+50 Pt78 | 551067.12 | 3680472.76 | -4.86 | CLR | Book# 060856 |
| 51+50 Pt79 | 551066.73 | 3680466.78 | -4.96 | RD | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 51+50 Pt80 | 551066.28 | 3680459.79 | -5.26 | ER | Book# 060856 |
| 51+50 Pt81 | 551066.28 | 3680459.79 | -4.86 | TPC | Book# 060856 |
| 51+50 Pt82 | 551066.22 | 3680458.79 | -4.86 | TPC | Book# 060856 |
| 51+50 Pt83 | 551065.51 | 3680447.82 | -4.86 | ES | Book# 060856 |
| 51+50 Pt84 | 551065.25 | 3680443.82 | -4.76 | ES | Book# 060856 |
| 51+50 Pt85 | 551064.74 | 3680435.84 | -4.71 | ES | Book# 060856 |
| 51+50 Pt86 | 551064.29 | 3680428.85 | -4.76 | ES | Book# 060856 |
| 51+50 Pt87 | 551063.52 | 3680416.88 | -4.76 | NG | Book# 060856 |
| 51+50 Pt88 | 551062.23 | 3680396.92 | -4.86 | NG | Book# 060856 |
| 51+50 Pt89 | 551089.22 | 3680816.05 | -4.90 | SND | Book# 060856 |
| 51+50 Pt90 | 551088.57 | 3680806.07 | -9.70 | SND | Book# 060856 |
| 51+50 Pt91 | 551087.93 | 3680796.09 | -11.30 | SND | Book# 060856 |
| 51+50 Pt92 | 551087.29 | 3680786.11 | -11.60 | SND | Book# 060856 |
| 51+50 Pt93 | 551086.65 | 3680776.14 | -11.30 | SND | Book# 060856 |
| 51+50 Pt94 | 551086.65 | 3680776.14 | -11.30 | CL | Book# 060856 |
| | | | | | |
| 52+00 Pt01 | 551059.10 | 3681126.64 | -4.42 | BLD | Book# 060856 |
| 52+00 Pt02 | 551058.59 | 3681118.65 | -4.22 | NG | Book# 060856 |
| 52+00 Pt03 | 551057.30 | 3681098.69 | -6.42 | ER | Book# 060856 |
| 52+00 Pt04 | 551056.53 | 3681086.72 | -6.12 | CLR | Book# 060856 |
| 52+00 Pt05 | 551055.83 | 3681075.74 | -6.32 | ER | Book# 060856 |
| 52+00 Pt06 | 551055.38 | 3681068.76 | -0.92 | PL | Book# 060856 |
| 52+00 Pt07 | 551054.67 | 3681057.78 | -0.52 | TOP | Book# 060856 |
| 52+00 Pt08 | 551054.54 | 3681055.78 | -2.22 | TOE | Book# 060856 |
| 52+00 Pt09 | 551053.96 | 3681046.80 | -1.02 | TOP | Book# 060856 |
| 52+00 Pt10 | 551052.16 | 3681018.86 | -1.72 | NG | Book# 060856 |
| 52+00 Pt11 | 551059.10 | 3681126.64 | -4.42 | SD | Book# 060856 |
| 52+00 Pt12 | 551058.59 | 3681118.65 | -4.22 | SD | Book# 060856 |
| 52+00 Pt13 | 551057.30 | 3681098.69 | -6.42 | SD | Book# 060856 |
| 52+00 Pt14 | 551056.53 | 3681086.72 | -6.12 | SD | Book# 060856 |
| 52+00 Pt15 | 551055.38 | 3681068.76 | -0.92 | SD | Book# 060856 |
| 52+00 Pt16 | 551054.67 | 3681057.78 | -0.52 | SD | Book# 060856 |
| 52+00 Pt17 | 551054.54 | 3681055.78 | -2.22 | SD | Book# 060856 |
| 52+00 Pt18 | 551053.96 | 3681046.80 | -1.02 | SD | Book# 060856 |
| 52+00 Pt19 | 551052.16 | 3681018.86 | -1.72 | SD | Book# 060856 |
| 52+00 Pt20 | 551050.30 | 3680989.92 | -3.04 | SD | Book# 060856 |
| 52+00 Pt21 | 551049.59 | 3680978.94 | 0.06 | SD | Book# 060856 |
| 52+00 Pt22 | 551048.95 | 3680968.96 | 0.56 | SD | Book# 060856 |
| 52+00 Pt23 | 551047.28 | 3680943.02 | -4.54 | SD | Book# 060856 |
| 52+00 Pt24 | 551045.74 | 3680919.07 | -3.54 | SD | Book# 060856 |
| 52+00 Pt25 | 551050.30 | 3680989.92 | -3.04 | TOE | Book# 060856 |
| 52+00 Pt26 | 551049.59 | 3680978.94 | 0.06 | TOP | Book# 060856 |
| 52+00 Pt27 | 551048.95 | 3680968.96 | 0.56 | TOP | Book# 060856 |
| 52+00 Pt28 | 551047.28 | 3680943.02 | -4.54 | TOE | Book# 060856 |
| 52+00 Pt29 | 551045.74 | 3680919.07 | -3.54 | SLP | Book# 060856 |
| 52+00 Pt30 | 551045.29 | 3680912.08 | -0.24 | TOP | Book# 060856 |
| 52+00 Pt31 | 551044.39 | 3680898.11 | -2.54 | TOE | Book# 060856 |
| 52+00 Pt32 | 551042.53 | 3680869.17 | -1.44 | NG | Book# 060856 |
| 52+00 Pt33 | 551042.34 | 3680866.18 | -0.94 | FST | Book# 060856 |
| 52+00 Pt34 | 551041.89 | 3680859.19 | -0.34 | SLP | Book# 060856 |
| 52+00 Pt35 | 551041.05 | 3680846.22 | 3.16 | LSC | Book# 060856 |
| 52+00 Pt36 | 551040.79 | 3680842.23 | 3.46 | TEF | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 52+00 Pt37 | 551040.79 | 3680842.23 | 12.90 | TPF | Book# 060856 |
| 52+00 Pt38 | 551045.29 | 3680912.08 | -0.24 | SD | Book# 060856 |
| 52+00 Pt39 | 551044.39 | 3680898.11 | -2.54 | SD | Book# 060856 |
| 52+00 Pt40 | 551040.73 | 3680841.23 | 12.87 | TPF | Book# 060856 |
| 52+00 Pt41 | 551040.67 | 3680840.23 | 3.31 | TEF | Book# 060856 |
| 52+00 Pt42 | 551040.41 | 3680836.24 | 3.31 | TBK | Book# 060856 |
| 52+00 Pt43 | 551039.96 | 3680829.25 | 1.21 | TOP | Book# 060856 |
| 52+00 Pt44 | 551039.70 | 3680825.26 | -0.89 | WES | Book# 060856 |
| 52+00 Pt45 | 551033.47 | 3680728.46 | -0.89 | WES | Book# 060856 |
| 52+00 Pt46 | 551033.28 | 3680725.47 | 2.81 | TBK | Book# 060856 |
| 52+00 Pt47 | 551032.76 | 3680717.48 | 2.91 | TEF | Book# 060856 |
| 52+00 Pt48 | 551032.76 | 3680717.48 | 12.88 | TPF | Book# 060856 |
| 52+00 Pt49 | 551032.70 | 3680716.49 | 12.89 | TPF | Book# 060856 |
| 52+00 Pt50 | 551032.64 | 3680715.49 | 3.61 | TEF | Book# 060856 |
| 52+00 Pt51 | 551032.19 | 3680708.50 | 3.41 | CLR | Book# 060856 |
| 52+00 Pt52 | 551031.67 | 3680700.52 | 3.01 | TOP | Book# 060856 |
| 52+00 Pt53 | 551031.16 | 3680692.54 | -1.89 | TOE | Book# 060856 |
| 52+00 Pt54 | 551030.52 | 3680682.56 | -3.09 | FL | Book# 060856 |
| 52+00 Pt55 | 551030.45 | 3680681.56 | -4.29 | TOE | Book# 060856 |
| 52+00 Pt56 | 551029.68 | 3680669.58 | -4.99 | NG | Book# 060856 |
| 52+00 Pt57 | 551026.47 | 3680619.69 | -4.89 | NG | Book# 060856 |
| 52+00 Pt58 | 551023.26 | 3680569.79 | -5.19 | NG | Book# 060856 |
| 52+00 Pt59 | 551020.04 | 3680519.89 | -5.19 | NG | Book# 060856 |
| 52+00 Pt60 | 551019.08 | 3680504.92 | -4.69 | FL | Book# 060856 |
| 52+00 Pt61 | 551018.95 | 3680502.93 | -4.89 | ES | Book# 060856 |
| 52+00 Pt62 | 551018.76 | 3680499.93 | -4.99 | ES | Book# 060856 |
| 52+00 Pt63 | 551018.05 | 3680488.96 | -4.99 | TPC | Book# 060856 |
| 52+00 Pt64 | 551017.99 | 3680487.96 | -5.44 | ER | Book# 060856 |
| 52+00 Pt65 | 551017.15 | 3680474.99 | -5.09 | CLR | Book# 060856 |
| 52+00 Pt66 | 551016.83 | 3680470.00 | -5.09 | RD | Book# 060856 |
| 52+00 Pt67 | 551016.38 | 3680463.01 | -5.49 | ER | Book# 060856 |
| 52+00 Pt68 | 551016.25 | 3680461.01 | -5.19 | TPC | Book# 060856 |
| 52+00 Pt69 | 551015.55 | 3680450.04 | -5.29 | ES | Book# 060856 |
| 52+00 Pt70 | 551015.29 | 3680446.05 | -4.99 | ES | Book# 060856 |
| 52+00 Pt71 | 551014.13 | 3680428.08 | -4.59 | BLD | Book# 060856 |
| 52+00 Pt72 | 551039.32 | 3680819.27 | -6.00 | SND | Book# 060856 |
| 52+00 Pt73 | 551038.67 | 3680809.29 | -9.00 | SND | Book# 060856 |
| 52+00 Pt74 | 551038.03 | 3680799.31 | -9.70 | SND | Book# 060856 |
| 52+00 Pt75 | 551037.39 | 3680789.33 | -10.40 | SND | Book# 060856 |
| 52+00 Pt76 | 551036.75 | 3680779.36 | -11.20 | SND | Book# 060856 |
| 52+00 Pt77 | 551036.10 | 3680769.38 | -11.60 | SND | Book# 060856 |
| 52+00 Pt78 | 551036.10 | 3680769.38 | -11.60 | CL | Book# 060856 |
| | | | | | |
| 58+50 Pt01 | 550406.72 | 3681110.51 | -3.93 | NG | Book# 060856 |
| 58+50 Pt02 | 550405.12 | 3681085.56 | -4.13 | NG | Book# 060856 |
| 58+50 Pt03 | 550404.03 | 3681068.59 | -3.23 | BLD | Book# 060856 |
| 58+50 Pt04 | 550401.46 | 3681028.68 | -3.73 | BLD | Book# 060856 |
| 58+50 Pt05 | 550400.30 | 3681010.71 | -3.93 | NG | Book# 060856 |
| 58+50 Pt06 | 550398.69 | 3680985.76 | -3.83 | NG | Book# 060856 |
| 58+50 Pt07 | 550397.09 | 3680960.82 | -3.63 | NG | Book# 060856 |
| 58+50 Pt08 | 550395.48 | 3680935.87 | -3.23 | NG | Book# 060856 |
| 58+50 Pt09 | 550394.52 | 3680920.90 | -2.33 | FL | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 58+50 Pt10 | 550394.20 | 3680915.91 | -1.73 | TOE | Book# 060856 |
| 58+50 Pt11 | 550393.87 | 3680910.92 | -0.23 | SLP | Book# 060856 |
| 58+50 Pt12 | 550393.10 | 3680898.94 | 2.97 | LSC | Book# 060856 |
| 58+50 Pt13 | 550392.53 | 3680889.96 | 3.67 | TEF | Book# 060856 |
| 58+50 Pt14 | 550392.53 | 3680889.96 | 12.72 | TPF | Book# 060856 |
| 58+50 Pt15 | 550392.46 | 3680888.97 | 12.72 | TPF | Book# 060856 |
| 58+50 Pt16 | 550392.40 | 3680887.97 | 4.17 | TEF | Book# 060856 |
| 58+50 Pt17 | 550392.20 | 3680884.97 | 3.87 | TBK | Book# 060856 |
| 58+50 Pt18 | 550392.08 | 3680882.98 | 3.20 | TSP | Book# 060856 |
| 58+50 Pt19 | 550392.08 | 3680882.98 | -1.23 | WES | Book# 060856 |
| 58+50 Pt20 | 550392.08 | 3680882.98 | -1.50 | SND | Book# 060856 |
| 58+50 Pt21 | 550391.95 | 3680880.98 | -1.90 | SND | Book# 060856 |
| 58+50 Pt22 | 550391.30 | 3680871.00 | -4.50 | SND | Book# 060856 |
| 58+50 Pt23 | 550390.66 | 3680861.02 | -6.10 | SND | Book# 060856 |
| 58+50 Pt24 | 550390.02 | 3680851.04 | -9.60 | SND | Book# 060856 |
| 58+50 Pt25 | 550389.38 | 3680841.06 | -10.10 | SND | Book# 060856 |
| 58+50 Pt26 | 550388.73 | 3680831.09 | -9.90 | SND | Book# 060856 |
| 58+50 Pt27 | 550388.09 | 3680821.11 | -8.10 | SND | Book# 060856 |
| 58+50 Pt28 | 550388.09 | 3680821.11 | -8.10 | CL | Book# 060856 |
| | | | | | |
| 59+00 Pt01 | 550356.83 | 3681113.72 | -4.23 | DRV | Book# 060856 |
| 59+00 Pt02 | 550355.22 | 3681088.77 | -4.03 | DRV | Book# 060856 |
| 59+00 Pt03 | 550354.71 | 3681080.78 | -3.93 | BLD | Book# 060856 |
| 59+00 Pt04 | 550349.89 | 3681005.94 | -3.63 | BLD | Book# 060856 |
| 59+00 Pt05 | 550348.80 | 3680988.97 | -3.63 | NG | Book# 060856 |
| 59+00 Pt06 | 550347.19 | 3680964.03 | -3.73 | NG | Book# 060856 |
| 59+00 Pt07 | 550345.58 | 3680939.08 | -3.83 | NG | Book# 060856 |
| 59+00 Pt08 | 550344.56 | 3680923.11 | -3.53 | FL | Book# 060856 |
| 59+00 Pt09 | 550343.98 | 3680914.13 | -0.73 | NG | Book# 060856 |
| 59+00 Pt10 | 550343.21 | 3680902.15 | 3.17 | LSC | Book# 060856 |
| 59+00 Pt11 | 550342.76 | 3680895.17 | 3.67 | TEF | Book# 060856 |
| 59+00 Pt12 | 550344.56 | 3680923.11 | -3.53 | TOE | Book# 060856 |
| 59+00 Pt13 | 550342.76 | 3680895.17 | 12.77 | TPF | Book# 060856 |
| 59+00 Pt14 | 550342.69 | 3680894.17 | 12.77 | TPF | Book# 060856 |
| 59+00 Pt15 | 550342.63 | 3680893.17 | 3.27 | TEF | Book# 060856 |
| 59+00 Pt16 | 550342.31 | 3680888.18 | 2.87 | TBK | Book# 060856 |
| 59+00 Pt17 | 550342.31 | 3680888.18 | 3.77 | TSP | Book# 060856 |
| 59+00 Pt18 | 550342.24 | 3680887.19 | 1.17 | TOE | Book# 060856 |
| 59+00 Pt19 | 550341.86 | 3680881.20 | -1.23 | WE | Book# 060856 |
| 59+00 Pt20 | 550335.24 | 3680778.41 | -1.23 | WES | Book# 060856 |
| 59+00 Pt21 | 550335.18 | 3680777.41 | 1.17 | TOP | Book# 060856 |
| 59+00 Pt22 | 550334.53 | 3680767.43 | 2.17 | TOE | Book# 060856 |
| 59+00 Pt23 | 550334.53 | 3680767.43 | 3.87 | TSP | Book# 060856 |
| 59+00 Pt24 | 550334.47 | 3680766.44 | 2.87 | TBK | Book# 060856 |
| 59+00 Pt25 | 550334.28 | 3680763.44 | 3.57 | TEF | Book# 060856 |
| 59+00 Pt26 | 550334.28 | 3680763.44 | 12.87 | TPF | Book# 060856 |
| 59+00 Pt27 | 550334.21 | 3680762.44 | 12.87 | TPF | Book# 060856 |
| 59+00 Pt28 | 550341.86 | 3680881.20 | -3.22 | SND | Book# 060856 |
| 59+00 Pt29 | 550341.41 | 3680874.21 | -6.62 | SND | Book# 060856 |
| 59+00 Pt30 | 550340.77 | 3680864.23 | -9.52 | SND | Book# 060856 |
| 59+00 Pt31 | 550340.12 | 3680854.25 | -9.92 | SND | Book# 060856 |
| 59+00 Pt32 | 550339.48 | 3680844.27 | -9.82 | SND | Book# 060856 |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 59+00 Pt33 | 550338.84 | 3680834.29 | -9.92 | SND | Book# 060856 |
| 59+00 Pt34 | 550338.20 | 3680824.32 | -9.62 | SND | Book# 060856 |
| 59+00 Pt35 | 550337.55 | 3680814.34 | -9.92 | SND | Book# 060856 |
| 59+00 Pt36 | 550336.91 | 3680804.36 | -10.62 | SND | Book# 060856 |
| 59+00 Pt37 | 550336.27 | 3680794.38 | -8.02 | SND | Book# 060856 |
| 59+00 Pt38 | 550335.63 | 3680784.40 | -2.22 | SND | Book# 060856 |
| 59+00 Pt39 | 550338.20 | 3680824.32 | -9.62 | CL | Book# 060856 |
| | | | | | |
| 59+50 Pt01 | 550306.93 | 3681116.94 | -4.13 | NG | Book# 060856 |
| 59+50 Pt02 | 550305.32 | 3681091.99 | -3.43 | NG | Book# 060856 |
| 59+50 Pt03 | 550304.48 | 3681079.02 | -3.73 | BLD | Book# 060856 |
| 59+50 Pt04 | 550302.24 | 3681044.09 | -3.38 | BLD | Book# 060856 |
| 59+50 Pt05 | 550300.50 | 3681017.14 | -2.98 | NG | Book# 060856 |
| 59+50 Pt06 | 550298.90 | 3680992.19 | -3.38 | NG | Book# 060856 |
| 59+50 Pt07 | 550297.29 | 3680967.25 | -3.58 | NG | Book# 060856 |
| 59+50 Pt08 | 550295.68 | 3680942.30 | -3.58 | NG | Book# 060856 |
| 59+50 Pt09 | 550294.66 | 3680926.33 | -2.98 | FL | Book# 060856 |
| 59+50 Pt10 | 550294.08 | 3680917.35 | -1.08 | SLP | Book# 060856 |
| 59+50 Pt11 | 550293.31 | 3680905.37 | 3.42 | LSC | Book# 060856 |
| 59+50 Pt12 | 550292.86 | 3680898.39 | 9.57 | TEF | Book# 060856 |
| 59+50 Pt13 | 550294.66 | 3680926.33 | 2.77 | TOE | Book# 060856 |
| 59+50 Pt14 | 550292.86 | 3680898.39 | 12.77 | TPF | Book# 060856 |
| 59+50 Pt15 | 550292.79 | 3680897.39 | 12.77 | TPF | Book# 060856 |
| 59+50 Pt16 | 550292.73 | 3680896.39 | 2.97 | TEF | Book# 060856 |
| 59+50 Pt17 | 550292.41 | 3680891.40 | 2.67 | TBK | Book# 060856 |
| 59+50 Pt18 | 550292.41 | 3680891.40 | 4.07 | TSP | Book# 060856 |
| 59+50 Pt19 | 550292.34 | 3680890.41 | -0.23 | TOE | Book# 060856 |
| 59+50 Pt20 | 550292.09 | 3680886.41 | -1.23 | WES | Book# 060856 |
| 59+50 Pt21 | 550292.41 | 3680891.40 | -0.42 | SND | Book# 060856 |
| 59+50 Pt22 | 550292.15 | 3680887.41 | -0.92 | SND | Book# 060856 |
| 59+50 Pt23 | 550291.51 | 3680877.43 | -5.22 | SND | Book# 060856 |
| 59+50 Pt24 | 550290.87 | 3680867.45 | -10.02 | SND | Book# 060856 |
| 59+50 Pt25 | 550290.22 | 3680857.47 | -10.32 | SND | Book# 060856 |
| 59+50 Pt26 | 550289.58 | 3680847.49 | -10.22 | SND | Book# 060856 |
| 59+50 Pt27 | 550288.94 | 3680837.51 | -10.02 | SND | Book# 060856 |
| 59+50 Pt28 | 550288.30 | 3680827.54 | -10.22 | SND | Book# 060856 |
| 59+50 Pt29 | 550288.30 | 3680827.54 | -10.22 | CL | Book# 060856 |

# Appendix 20
# Topographic and Hydrographic Cross Section Data

## Inner Harbor Navigation Canal -- East Bank

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 0+00 Pt01 | 540620.99 | 3696285.94 | -1.91 | SND | Book# 060858 |
| 0+00 Pt02 | 540625.90 | 3696266.56 | -5.71 | SND | Book# 060858 |
| 0+00 Pt03 | 540630.81 | 3696247.17 | -15.31 | SND | Book# 060858 |
| 0+00 Pt04 | 540635.71 | 3696227.78 | -20.61 | SND | Book# 060858 |
| 0+00 Pt05 | 540640.62 | 3696208.39 | -23.31 | SND | Book# 060858 |
| 0+00 Pt06 | 540645.53 | 3696189.00 | -23.61 | SND | Book# 060858 |
| 0+00 Pt07 | 540650.43 | 3696169.61 | -25.81 | SND | Book# 060858 |
| 0+00 Pt08 | 540655.34 | 3696150.22 | -27.91 | SND | Book# 060858 |
| 0+00 Pt09 | 540660.25 | 3696130.83 | -28.31 | SND | Book# 060858 |
| 0+00 Pt10 | 540665.15 | 3696111.45 | -27.81 | SND | Book# 060858 |
| 0+00 Pt11 | 540670.06 | 3696092.06 | -29.31 | SND | Book# 060858 |
| 0+00 Pt12 | 540674.97 | 3696072.67 | -33.31 | SND | Book# 060858 |
| 0+00 Pt13 | 540679.87 | 3696053.28 | -34.71 | SND | Book# 060858 |
| 0+00 Pt14 | 540684.78 | 3696033.89 | -37.61 | SND | Book# 060858 |
| 0+00 Pt15 | 540689.69 | 3696014.50 | -38.51 | SND | Book# 060858 |
| 0+00 Pt16 | 540694.59 | 3695995.11 | -39.71 | SND | Book# 060858 |
| 0+00 Pt17 | 540699.50 | 3695975.72 | -38.51 | SND | Book# 060858 |
| 0+00 Pt18 | 540699.50 | 3695975.72 | -38.51 | CL | Book# 060858 |
| 0+00 Pt19 | 540618.04 | 3696297.59 | -0.69 | WES | IHNCEAST.dc |
| 0+00 Pt20 | 540602.86 | 3696365.81 | 5.07 | TOP | IHNCEAST.dc |
| 0+00 Pt21 | 540600.82 | 3696368.24 | 2.90 | TOE | IHNCEAST.dc |
| 0+00 Pt22 | 540600.63 | 3696371.06 | 2.58 | TOE | IHNCEAST.dc |
| 0+00 Pt23 | 540600.03 | 3696373.23 | 4.25 | TOP | IHNCEAST.dc |
| 0+00 Pt24 | 540596.72 | 3696384.48 | 1.84 | TOE | IHNCEAST.dc |
| 0+00 Pt25 | 540593.03 | 3696399.09 | 0.60 | E ROAD | IHNCEAST.dc |
| 0+00 Pt26 | 540585.06 | 3696424.74 | 0.19 | ON ROAD | IHNCEAST.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 0+00 Pt27 | 540574.15 | 3696471.53 | -0.75 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt28 | 540561.63 | 3696520.23 | -1.34 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt29 | 540549.86 | 3696566.48 | -1.54 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt30 | 540616.01 | 3696307.35 | 0.70 | TOE | IHNCEAST.dc |
| 0+00 Pt31 | 540537.04 | 3696618.07 | -1.93 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt32 | 540524.48 | 3696668.27 | -2.48 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt33 | 540508.83 | 3696729.95 | -3.33 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt34 | 540496.44 | 3696775.74 | -4.74 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt35 | 540484.56 | 3696820.81 | -5.55 | ON ROAD | IHNCEAST.dc |
| 0+00 Pt36 | 540613.89 | 3696314.74 | 2.04 | TBK | IHNCEAST.dc |
| 0+00 Pt37 | 540608.41 | 3696337.61 | 2.36 | TOE | IHNCEAST.dc |
| 0+00 Pt38 | 540603.19 | 3696357.00 | 4.73 | TOP | IHNCEAST.dc |
| 0+00 Pt39 | 540601.74 | 3696362.30 | 5.20 | TOE CONC FLDWALL | IHNCEAST.dc |
| 0+00 Pt40 | 540601.98 | 3696362.82 | 12.62 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 0+00 Pt41 | 540602.19 | 3696363.60 | 12.64 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 0+00 Pt42 | 540602.43 | 3696364.03 | 5.34 | TOE CONC FLDWALL | IHNCEAST.dc |
| | | | | | |
| 0+50 Pt01 | 540572.61 | 3696273.77 | -1.41 | SND | Book# 060858 |
| 0+50 Pt02 | 540577.52 | 3696254.38 | -2.71 | SND | Book# 060858 |
| 0+50 Pt03 | 540582.42 | 3696234.99 | -9.31 | SND | Book# 060858 |
| 0+50 Pt04 | 540587.33 | 3696215.60 | -19.51 | SND | Book# 060858 |
| 0+50 Pt05 | 540592.24 | 3696196.21 | -25.81 | SND | Book# 060858 |
| 0+50 Pt06 | 540597.14 | 3696176.82 | -27.71 | SND | Book# 060858 |
| 0+50 Pt07 | 540602.05 | 3696157.43 | -29.61 | SND | Book# 060858 |
| 0+50 Pt08 | 540606.96 | 3696138.04 | -31.31 | SND | Book# 060858 |
| 0+50 Pt09 | 540611.86 | 3696118.66 | -31.71 | SND | Book# 060858 |
| 0+50 Pt10 | 540616.77 | 3696099.27 | -32.41 | SND | Book# 060858 |
| 0+50 Pt11 | 540621.68 | 3696079.88 | -32.71 | SND | Book# 060858 |
| 0+50 Pt12 | 540626.58 | 3696060.49 | -34.01 | SND | Book# 060858 |
| 0+50 Pt13 | 540631.49 | 3696041.10 | -34.81 | SND | Book# 060858 |
| 0+50 Pt14 | 540636.40 | 3696021.71 | -36.41 | SND | Book# 060858 |
| 0+50 Pt15 | 540641.30 | 3696002.32 | -39.11 | SND | Book# 060858 |
| 0+50 Pt16 | 540646.21 | 3695982.93 | -40.21 | SND | Book# 060858 |
| 0+50 Pt17 | 540651.12 | 3695963.55 | -40.61 | SND | Book# 060858 |
| 0+50 Pt18 | 540430.84 | 3696834.47 | -4.97 | NG-JUNK PILE | IHNCEAST.dc |
| 0+50 Pt19 | 540466.11 | 3696694.41 | -5.85 | TOE | IHNCEAST.dc |
| 0+50 Pt20 | 540470.01 | 3696678.90 | -5.82 | TOE | IHNCEAST.dc |
| 0+50 Pt21 | 540477.87 | 3696653.85 | -3.95 | SLP | IHNCEAST.dc |
| 0+50 Pt22 | 540483.44 | 3696626.44 | -2.89 | SLP | IHNCEAST.dc |
| 0+50 Pt23 | 540486.15 | 3696614.10 | -1.11 | TOP | IHNCEAST.dc |
| 0+50 Pt24 | 540494.87 | 3696582.29 | -1.10 | NG | IHNCEAST.dc |
| 0+50 Pt25 | 540506.16 | 3696535.65 | -0.76 | NG | IHNCEAST.dc |
| 0+50 Pt26 | 540516.50 | 3696492.38 | 0.00 | NG | IHNCEAST.dc |
| 0+50 Pt27 | 540527.14 | 3696453.62 | 0.90 | E LEVEE RAMP | IHNCEAST.dc |
| 0+50 Pt28 | 540533.00 | 3696429.73 | 1.66 | C\L LEVEE RAMP | IHNCEAST.dc |
| 0+50 Pt29 | 540440.31 | 3696796.19 | -5.00 | NG-JUNK PILE | IHNCEAST.dc |
| 0+50 Pt30 | 540538.27 | 3696409.97 | 2.00 | E LEVEE RAMP | IHNCEAST.dc |
| 0+50 Pt31 | 540538.91 | 3696405.81 | 2.06 | TOE | IHNCEAST.dc |
| 0+50 Pt32 | 540539.20 | 3696402.32 | 3.31 | TOP | IHNCEAST.dc |
| 0+50 Pt33 | 540540.46 | 3696401.30 | 3.25 | EDGE CONC SLAB | IHNCEAST.dc |
| 0+50 Pt34 | 540541.79 | 3696394.91 | 3.17 | EDGE CONC SLAB | IHNCEAST.dc |
| 0+50 Pt35 | 540541.98 | 3696393.80 | 3.60 | TOP | IHNCEAST.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 0+50 Pt36 | 540543.79 | 3696388.33 | 3.91 | TOE | IHNCEAST.dc |
| 0+50 Pt37 | 540544.76 | 3696382.74 | 5.57 | TOP | IHNCEAST.dc |
| 0+50 Pt38 | 540545.18 | 3696380.63 | 3.44 | TOE | IHNCEAST.dc |
| 0+50 Pt39 | 540546.37 | 3696377.71 | 3.93 | TOE FLDWALL | IHNCEAST.dc |
| 0+50 Pt40 | 540451.07 | 3696758.62 | -4.86 | NG-JUNK PILE | IHNCEAST.dc |
| 0+50 Pt41 | 540546.58 | 3696377.83 | 5.18 | TOP | IHNCEAST.dc |
| 0+50 Pt42 | 540546.79 | 3696376.33 | 5.33 | TOE CONC FLDWALL | IHNCEAST.dc |
| 0+50 Pt43 | 540546.84 | 3696375.81 | 12.56 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 0+50 Pt44 | 540547.01 | 3696374.68 | 12.59 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 0+50 Pt45 | 540547.28 | 3696374.47 | 6.55 | TOE CONC FLDWALL | IHNCEAST.dc |
| 0+50 Pt46 | 540548.50 | 3696370.52 | 6.31 | TOP | IHNCEAST.dc |
| 0+50 Pt47 | 540550.06 | 3696364.80 | 5.30 | TOE | IHNCEAST.dc |
| 0+50 Pt48 | 540555.74 | 3696341.16 | 4.55 | NG | IHNCEAST.dc |
| 0+50 Pt49 | 540566.29 | 3696298.04 | 3.37 | TBK | IHNCEAST.dc |
| 0+50 Pt50 | 540566.97 | 3696296.64 | 1.92 | TOP EDGE OF RIP RAP | IHNCEAST.dc |
| 0+50 Pt51 | 540453.92 | 3696734.98 | -5.40 | NG-JUNK PILE | IHNCEAST.dc |
| 0+50 Pt52 | 540570.29 | 3696284.54 | -0.58 | EDGE RIP RAP | IHNCEAST.dc |
| 0+50 Pt53 | 540570.59 | 3696282.74 | -0.75 | WES | IHNCEAST.dc |
| 0+50 Pt54 | 540457.03 | 3696732.78 | -5.35 | E ROAD | IHNCEAST.dc |
| 0+50 Pt55 | 540458.75 | 3696722.95 | -5.32 | CL ROAD | IHNCEAST.dc |
| 0+50 Pt56 | 540460.77 | 3696717.19 | -5.26 | E ROAD | IHNCEAST.dc |
| 0+50 Pt57 | 540461.75 | 3696713.81 | -5.45 | TOE | IHNCEAST.dc |
| 0+50 Pt58 | 540463.53 | 3696707.30 | -4.07 | TOP | IHNCEAST.dc |
| | | | | | |
| 41+65 Pt01 | 536592.68 | 3695205.28 | -1.61 | SND | Book# 060858 |
| 41+65 Pt02 | 536599.52 | 3695186.49 | -3.41 | SND | Book# 060858 |
| 41+65 Pt03 | 536606.36 | 3695167.69 | -5.51 | SND | Book# 060858 |
| 41+65 Pt04 | 536613.20 | 3695148.90 | -6.81 | SND | Book# 060858 |
| 41+65 Pt05 | 536620.04 | 3695130.10 | -5.11 | SND | Book# 060858 |
| 41+65 Pt06 | 536626.88 | 3695111.31 | -8.11 | SND | Book# 060858 |
| 41+65 Pt07 | 536633.72 | 3695092.52 | -9.41 | SND | Book# 060858 |
| 41+65 Pt08 | 536640.56 | 3695073.72 | -9.31 | SND | Book# 060858 |
| 41+65 Pt09 | 536647.40 | 3695054.93 | -14.11 | SND | Book# 060858 |
| 41+65 Pt10 | 536653.22 | 3695038.95 | -10.21 | SND | Book# 060858 |
| 41+65 Pt11 | 536661.08 | 3695017.34 | -20.61 | SND | Book# 060858 |
| 41+65 Pt12 | 536667.92 | 3694998.55 | -22.31 | SND | Book# 060858 |
| 41+65 Pt13 | 536674.76 | 3694979.75 | -24.21 | SND | Book# 060858 |
| 41+65 Pt14 | 536681.60 | 3694960.96 | -25.91 | SND | Book# 060858 |
| 41+65 Pt15 | 536688.45 | 3694942.17 | -27.21 | SND | Book# 060858 |
| 41+65 Pt16 | 536695.29 | 3694923.37 | -30.31 | SND | Book# 060858 |
| 41+65 Pt17 | 536702.13 | 3694904.58 | -32.41 | SND | Book# 060858 |
| 41+65 Pt18 | 536708.97 | 3694885.78 | -32.91 | SND | Book# 060858 |
| 41+65 Pt19 | 536715.81 | 3694866.99 | -32.51 | SND | Book# 060858 |
| 41+65 Pt20 | 536715.81 | 3694866.99 | -32.51 | CL | Book# 060858 |
| 41+65 Pt21 | 536529.11 | 3695379.06 | 0.08 | EDGE OF BLDG | IHNCEAST.dc |
| 41+65 Pt22 | 536447.32 | 3695605.21 | -2.60 | E ROAD | IHNCEAST.dc |
| 41+65 Pt23 | 536445.62 | 3695611.19 | -2.35 | TOE | IHNCEAST.dc |
| 41+65 Pt24 | 536445.33 | 3695613.70 | -1.72 | FL / TOP | IHNCEAST.dc |
| 41+65 Pt25 | 536444.42 | 3695615.88 | -1.66 | E CONC SLAB | IHNCEAST.dc |
| 41+65 Pt26 | 536434.58 | 3695637.87 | -1.87 | NG | IHNCEAST.dc |
| 41+65 Pt27 | 536536.90 | 3695358.43 | -0.18 | ON ASPHALT | IHNCEAST.dc |
| 41+65 Pt28 | 536545.27 | 3695338.01 | -0.14 | ON ASPHALT | IHNCEAST.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 41+65 Pt29 | 536552.27 | 3695316.52 | 0.32 | E ASPHALT | IHNCEAST.dc |
| 41+65 Pt30 | 536552.42 | 3695315.70 | 0.68 | FL | IHNCEAST.dc |
| 41+65 Pt31 | 536557.52 | 3695303.01 | 0.61 | LST | IHNCEAST.dc |
| 41+65 Pt32 | 536495.48 | 3695471.57 | -0.43 | EDGE OF BLDG | IHNCEAST.dc |
| 41+65 Pt33 | 536560.61 | 3695291.92 | 4.04 | SLP | IHNCEAST.dc |
| 41+65 Pt34 | 536563.67 | 3695283.89 | 7.07 | LSC | IHNCEAST.dc |
| 41+65 Pt35 | 536566.30 | 3695277.43 | 7.49 | TOE CONC FLDWALL | IHNCEAST.dc |
| 41+65 Pt36 | 536566.87 | 3695275.99 | 13.40 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 41+65 Pt37 | 536566.93 | 3695275.76 | 13.40 | TOP EDGE CONC FLDWAL | IHNCEAST.dc |
| 41+65 Pt38 | 536566.81 | 3695275.33 | 7.09 | TOE CONC FLDWALL | IHNCEAST.dc |
| 41+65 Pt39 | 536567.71 | 3695272.24 | 6.56 | FSC | IHNCEAST.dc |
| 41+65 Pt40 | 536570.58 | 3695264.23 | 4.42 | SLP | IHNCEAST.dc |
| 41+65 Pt41 | 536576.09 | 3695253.19 | 2.41 | FST | IHNCEAST.dc |
| 41+65 Pt42 | 536572.34 | 3695260.25 | 3.47 | EDGE RIP RAP | IHNCEAST.dc |
| 41+65 Pt43 | 536486.69 | 3695496.80 | -0.66 | NG | IHNCEAST.dc |
| 41+65 Pt44 | 536578.11 | 3695243.26 | 1.83 | ON RIP RAP | IHNCEAST.dc |
| 41+65 Pt45 | 536584.67 | 3695225.90 | 2.02 | TBK | IHNCEAST.dc |
| 41+65 Pt46 | 536587.40 | 3695219.91 | 0.60 | ON RIP RAP | IHNCEAST.dc |
| 41+65 Pt47 | 536589.74 | 3695212.70 | 0.36 | ON RIP RAP | IHNCEAST.dc |
| 41+65 Pt48 | 536592.41 | 3695208.94 | -0.44 | WES | IHNCEAST.dc |
| 41+65 Pt49 | 536479.14 | 3695518.73 | -1.04 | FL | IHNCEAST.dc |
| 41+65 Pt50 | 536476.96 | 3695521.38 | -1.12 | TOP | IHNCEAST.dc |
| 41+65 Pt51 | 536465.26 | 3695553.77 | -3.49 | TOE | IHNCEAST.dc |
| 41+65 Pt52 | 536458.24 | 3695573.47 | -3.35 | NG | IHNCEAST.dc |
| 41+65 Pt53 | 536453.15 | 3695588.28 | -2.90 | E ROAD | IHNCEAST.dc |
| 41+65 Pt54 | 536450.37 | 3695597.45 | -2.68 | CL ROAD | IHNCEAST.dc |
| | | | | | |
| 44+00 Pt01 | 536406.14 | 3695030.86 | -2.01 | SND | Book# 060858 |
| 44+00 Pt02 | 536412.98 | 3695012.06 | -7.01 | SND | Book# 060858 |
| 44+00 Pt03 | 536419.82 | 3694993.27 | -11.71 | SND | Book# 060858 |
| 44+00 Pt04 | 536426.66 | 3694974.47 | -16.81 | SND | Book# 060858 |
| 44+00 Pt05 | 536433.50 | 3694955.68 | -19.01 | SND | Book# 060858 |
| 44+00 Pt06 | 536440.34 | 3694936.89 | -21.81 | SND | Book# 060858 |
| 44+00 Pt07 | 536447.18 | 3694918.09 | -24.71 | SND | Book# 060858 |
| 44+00 Pt08 | 536454.02 | 3694899.30 | -26.71 | SND | Book# 060858 |
| 44+00 Pt09 | 536460.86 | 3694880.50 | -27.61 | SND | Book# 060858 |
| 44+00 Pt10 | 536467.70 | 3694861.71 | -29.41 | SND | Book# 060858 |
| 44+00 Pt11 | 536474.54 | 3694842.92 | -33.21 | SND | Book# 060858 |
| 44+00 Pt12 | 536481.38 | 3694824.12 | -35.21 | SND | Book# 060858 |
| 44+00 Pt13 | 536488.22 | 3694805.33 | -33.71 | SND | Book# 060858 |
| 44+00 Pt14 | 536495.06 | 3694786.53 | -31.31 | SND | Book# 060858 |
| 44+00 Pt15 | 536481.38 | 3694824.12 | -35.21 | CL | Book# 060858 |
| 44+00 Pt16 | 536276.14 | 3695387.94 | -2.60 | ON ASPHALT | IHNCEAST.dc |
| 44+00 Pt17 | 536344.15 | 3695200.94 | -1.92 | NG | IHNCEAST.dc |
| 44+00 Pt18 | 536361.78 | 3695153.02 | -1.70 | NG | IHNCEAST.dc |
| 44+00 Pt19 | 536370.54 | 3695124.49 | -1.05 | FST | IHNCEAST.dc |
| 44+00 Pt20 | 536374.84 | 3695118.57 | 0.09 | SLP | IHNCEAST.dc |
| 44+00 Pt21 | 536381.12 | 3695099.85 | 6.44 | SLP | IHNCEAST.dc |
| 44+00 Pt22 | 536382.54 | 3695096.06 | 7.42 | FSC | IHNCEAST.dc |
| 44+00 Pt23 | 536384.16 | 3695091.34 | 7.64 | TOE CONC FLDWALL | IHNCEAST.dc |
| 44+00 Pt24 | 536384.80 | 3695089.70 | 13.27 | TOP CONC FLDWALL | IHNCEAST.dc |
| 44+00 Pt25 | 536384.94 | 3695089.47 | 13.33 | TOP CONC FLDWALL | IHNCEAST.dc |

| Station/<br>Name | Northing | Easting | Elevation | Description | Raw Data<br>Reference |
|---|---|---|---|---|---|
| 44+00 Pt26 | 536384.56 | 3695088.99 | 6.80 | TOE CONC FLDWALL | IHNCEAST.dc |
| 44+00 Pt27 | 536285.82 | 3695362.99 | -2.80 | ON ASPHALT | IHNCEAST.dc |
| 44+00 Pt28 | 536385.92 | 3695086.56 | 6.34 | FSC | IHNCEAST.dc |
| 44+00 Pt29 | 536386.56 | 3695082.90 | 5.28 | SLP | IHNCEAST.dc |
| 44+00 Pt30 | 536389.94 | 3695075.35 | 3.01 | FST | IHNCEAST.dc |
| 44+00 Pt31 | 536393.08 | 3695065.91 | 2.81 | NG | IHNCEAST.dc |
| 44+00 Pt32 | 536396.09 | 3695058.76 | 2.60 | TOE | IHNCEAST.dc |
| 44+00 Pt33 | 536398.09 | 3695055.03 | 3.06 | TOP | IHNCEAST.dc |
| 44+00 Pt34 | 536400.58 | 3695045.72 | 3.38 | TBK | IHNCEAST.dc |
| 44+00 Pt35 | 536402.38 | 3695039.41 | 1.36 | EDGE RIP RAP | IHNCEAST.dc |
| 44+00 Pt36 | 536404.59 | 3695035.14 | 1.97 | ON RIP RAP | IHNCEAST.dc |
| 44+00 Pt37 | 536405.06 | 3695030.21 | -0.57 | WES | IHNCEAST.dc |
| 44+00 Pt38 | 536297.66 | 3695328.47 | -3.10 | E ROAD | IHNCEAST.dc |
| 44+00 Pt39 | 536297.91 | 3695328.17 | -3.04 | TOE OF CURB | IHNCEAST.dc |
| 44+00 Pt40 | 536298.27 | 3695328.33 | -2.72 | TOE OF CURB | IHNCEAST.dc |
| 44+00 Pt41 | 536300.01 | 3695322.96 | -2.74 | TOE OF CURB | IHNCEAST.dc |
| 44+00 Pt42 | 536300.64 | 3695322.29 | -2.49 | NG | IHNCEAST.dc |
| 44+00 Pt43 | 536311.01 | 3695294.05 | -2.06 | NG | IHNCEAST.dc |
| 44+00 Pt44 | 536327.54 | 3695247.41 | -1.95 | NG | IHNCEAST.dc |
| | | | | | |
| 44+50 Pt01 | 536359.05 | 3695013.64 | -1.41 | SND | Book# 060858 |
| 44+50 Pt02 | 536365.89 | 3694994.84 | -7.61 | SND | Book# 060858 |
| 44+50 Pt03 | 536372.73 | 3694976.05 | -11.31 | SND | Book# 060858 |
| 44+50 Pt04 | 536379.57 | 3694957.25 | -17.11 | SND | Book# 060858 |
| 44+50 Pt05 | 536386.41 | 3694938.46 | -19.51 | SND | Book# 060858 |
| 44+50 Pt06 | 536393.25 | 3694919.67 | -21.61 | SND | Book# 060858 |
| 44+50 Pt07 | 536400.09 | 3694900.87 | -24.41 | SND | Book# 060858 |
| 44+50 Pt08 | 536406.93 | 3694882.08 | -26.41 | SND | Book# 060858 |
| 44+50 Pt09 | 536413.77 | 3694863.28 | -27.81 | SND | Book# 060858 |
| 44+50 Pt10 | 536420.61 | 3694844.49 | -30.21 | SND | Book# 060858 |
| 44+50 Pt11 | 536427.45 | 3694825.70 | -33.11 | SND | Book# 060858 |
| 44+50 Pt12 | 536434.29 | 3694806.90 | -35.61 | SND | Book# 060858 |
| 44+50 Pt13 | 536434.29 | 3694806.90 | -35.61 | CL | Book# 060858 |
| 44+50 Pt14 | 536359.82 | 3695014.89 | -0.67 | WES | IHNCEAST.dc |
| 44+50 Pt15 | 536339.39 | 3695066.75 | 6.67 | FSC | IHNCEAST.dc |
| 44+50 Pt16 | 536338.27 | 3695068.71 | 6.91 | TOE CONC FLDWALL | IHNCEAST.dc |
| 44+50 Pt17 | 536338.05 | 3695069.01 | 13.32 | TOP CONC FLDWALL | IHNCEAST.dc |
| 44+50 Pt18 | 536337.93 | 3695069.34 | 13.30 | TOP CONC FLDWALL | IHNCEAST.dc |
| 44+50 Pt19 | 536338.25 | 3695071.23 | 7.56 | TOE CONC FLDWALL | IHNCEAST.dc |
| 44+50 Pt20 | 536336.73 | 3695076.09 | 7.23 | LSC | IHNCEAST.dc |
| 44+50 Pt21 | 536333.22 | 3695082.70 | 5.45 | SLP | IHNCEAST.dc |
| 44+50 Pt22 | 536329.27 | 3695094.82 | 1.11 | SLP | IHNCEAST.dc |
| 44+50 Pt23 | 536328.62 | 3695102.11 | -0.54 | TOE | IHNCEAST.dc |
| 44+50 Pt24 | 536320.06 | 3695119.20 | -2.23 | NG | IHNCEAST.dc |
| 44+50 Pt25 | 536358.78 | 3695015.11 | 0.45 | ON RIP RAP | IHNCEAST.dc |
| 44+50 Pt26 | 536311.20 | 3695148.26 | -2.36 | NG | IHNCEAST.dc |
| 44+50 Pt27 | 536297.15 | 3695183.94 | -2.79 | NG | IHNCEAST.dc |
| 44+50 Pt28 | 536282.05 | 3695227.17 | -2.34 | E CONC DRIVEWAY | IHNCEAST.dc |
| 44+50 Pt29 | 536278.56 | 3695235.61 | -2.31 | E CONC DRIVEWAY | IHNCEAST.dc |
| 44+50 Pt30 | 536278.34 | 3695236.31 | -2.54 | E CONC DRIVEWAY | IHNCEAST.dc |
| 44+50 Pt31 | 536273.27 | 3695249.27 | -2.39 | FL | IHNCEAST.dc |
| 44+50 Pt32 | 536268.34 | 3695262.80 | -2.76 | FL | IHNCEAST.dc |

| Station/ Name | Northing | Easting | Elevation | Description | Raw Data Reference |
|---|---|---|---|---|---|
| 44+50 Pt33 | 536262.27 | 3695276.60 | -2.98 | NG | IHNCEAST.dc |
| 44+50 Pt34 | 536253.32 | 3695295.21 | -6.83 | FL | IHNCEAST.dc |
| 44+50 Pt35 | 536357.26 | 3695020.60 | 0.64 | EDGE RIP RAP | IHNCEAST.dc |
| 44+50 Pt36 | 536355.52 | 3695023.08 | 0.89 | TOE | IHNCEAST.dc |
| 44+50 Pt37 | 536352.42 | 3695036.13 | 3.45 | TOP | IHNCEAST.dc |
| 44+50 Pt38 | 536351.38 | 3695038.94 | 3.55 | TOP | IHNCEAST.dc |
| 44+50 Pt39 | 536349.52 | 3695042.73 | 2.88 | TOE | IHNCEAST.dc |
| 44+50 Pt40 | 536343.70 | 3695054.27 | 3.07 | FST | IHNCEAST.dc |
| 44+50 Pt41 | 536341.28 | 3695062.35 | 5.48 | SLP | IHNCEAST.dc |

# Appendix 21
# Bridge/Floodwall Ties

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**17th Street Canal at Veterans Blvd.**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 17TH3A1 | 547581.05 | 3663968.33 | 4.96 | TOE FLDGATE |
| 17TH3A10 | 547607.94 | 3663747.27 | 12.36 | TOP C\L CONC FLDWALL |
| 17TH3A11 | 547607.73 | 3663747.32 | 12.53 | TOP C\L CONC FLDWALL |
| 17TH3A12 | 547604.71 | 3663746.77 | 12.49 | END CONC FLDWALL |
| 17TH3A13 | 547596.69 | 3663745.82 | 12.53 | END CONC FLDWALL |
| 17TH3A14 | 547593.69 | 3663745.62 | 12.52 | TOP C\L CONC FLDWALL |
| 17TH3A15 | 547586.33 | 3663744.00 | 13.08 | TOP C\L CONC FLDWALL |
| 17TH3A16 | 547585.04 | 3663743.89 | 13.05 | TOP C\L CONC FLDWALL |
| 17TH3A17 | 547582.53 | 3663789.43 | 13.44 | TOP C\L CONC FLDWALL |
| 17TH3A18 | 547580.04 | 3663834.30 | 13.59 | TOP C\L CONC FLDWALL |
| 17TH3A19 | 547578.79 | 3663856.82 | 13.67 | TOP C\L CONC FLDWALL |
| 17TH3A2 | 547585.82 | 3663967.05 | 4.92 | TOE FLDGATE |
| 17TH3A20 | 547576.31 | 3663901.81 | 13.56 | TOP C\L CONC FLDWALL |
| 17TH3A21 | 547575.12 | 3663924.22 | 13.53 | TOP C\L CONC FLDWALL |
| 17TH3A22 | 547573.89 | 3663946.76 | 13.40 | TOP C\L CONC FLDWALL |
| 17TH3A23 | 547572.63 | 3663970.08 | 13.11 | TOP C\L CONC FLDWALL |
| 17TH3A24 | 547574.06 | 3663970.22 | 13.11 | TOP C\L CONC FLDWALL |
| 17TH3A25 | 547574.35 | 3663970.14 | 13.04 | TOP C\L CONC FLDWALL |
| 17TH3A26 | 547580.93 | 3663968.30 | 13.03 | END CONC FLDWALL |
| 17TH3A27 | 547585.78 | 3663967.03 | 12.98 | END CONC FLDWALL |
| 17TH3A28 | 547591.83 | 3663965.29 | 12.99 | TOP C\L CONC FLDWALL |
| 17TH3A29 | 547598.00 | 3663965.68 | 12.52 | TOP C\L CONC FLDWALL |
| 17TH3A3 | 547432.61 | 3663959.00 | 6.02 | TOE FLDGATE |
| 17TH3A30 | 547598.28 | 3663965.78 | 12.19 | TOP C\L CONC FLDWALL |
| 17TH3A31 | 547628.76 | 3663967.91 | 12.32 | TOP C\L CONC FLDWALL |
| 17TH3A32 | 547388.13 | 3663954.39 | 12.80 | TOP C\L CONC FLDWALL |
| 17TH3A33 | 547418.65 | 3663956.31 | 12.82 | TOP C\L CONC FLDWALL |
| 17TH3A34 | 547418.89 | 3663956.26 | 13.01 | TOP C\L CONC FLDWALL |
| 17TH3A35 | 547427.91 | 3663957.04 | 12.99 | TOP C\L CONC FLDWALL |

| | | | | |
|---|---|---|---|---|
| 17TH3A36 | 547432.42 | 3663959.02 | 13.06 | END CONC FLDWALL |
| 17TH3A37 | 547437.11 | 3663961.00 | 13.07 | END CONC FLDWALL |
| 17TH3A38 | 547441.78 | 3663962.64 | 13.10 | TOP C\L CONC FLDWALL |
| 17TH3A39 | 547442.09 | 3663962.85 | 13.12 | TOP C\L CONC FLDWALL |
| 17TH3A4 | 547436.83 | 3663960.84 | 6.05 | TOE FLDGATE |
| 17TH3A40 | 547443.38 | 3663963.12 | 13.14 | TOP C\L CONC FLDWALL |
| 17TH3A41 | 547446.00 | 3663917.00 | 13.46 | TOP C\L CONC FLDWALL |
| 17TH3A42 | 547448.46 | 3663872.57 | 13.63 | TOP C\L CONC FLDWALL |
| 17TH3A43 | 547450.95 | 3663827.49 | 13.65 | TOP C\L CONC FLDWALL |
| 17TH3A44 | 547452.22 | 3663804.75 | 13.64 | TOP C\L CONC FLDWALL |
| 17TH3A45 | 547454.64 | 3663759.89 | 13.27 | TOP C\L CONC FLDWALL |
| 17TH3A46 | 547455.95 | 3663736.82 | 13.04 | TOP C\L CONC FLDWALL |
| 17TH3A47 | 547454.61 | 3663736.75 | 13.01 | TOP C\L CONC FLDWALL |
| 17TH3A48 | 547454.36 | 3663736.67 | 12.96 | TOP C\L CONC FLDWALL |
| 17TH3A49 | 547451.16 | 3663736.75 | 12.97 | END CONC FLDWALL |
| 17TH3A5 | 547443.13 | 3663736.82 | 6.48 | TOE FLDGATE |
| 17TH3A50 | 547443.01 | 3663736.78 | 12.99 | END CONC FLDWALL |
| 17TH3A51 | 547441.73 | 3663736.85 | 12.99 | TOP C\L CONC FLDWALL |
| 17TH3A52 | 547441.60 | 3663736.96 | 12.83 | TOP C\L CONC FLDWALL |
| 17TH3A53 | 547413.15 | 3663737.10 | 12.83 | TOP C\L CONC FLDWALL |
| 17TH3A54 | 547382.25 | 3663737.32 | 12.86 | TOP C\L CONC FLDWALL |
| 17TH3A55 | 547350.90 | 3663736.47 | 12.85 | TOP C\L CONC FLDWALL |
| 17TH3A6 | 547450.80 | 3663736.58 | 6.45 | TOE FLDGATE |
| 17TH3A7 | 547604.58 | 3663746.68 | 6.01 | TOE FLDGATE |
| 17TH3A8 | 547596.73 | 3663746.00 | 6.09 | TOE FLDGATE |
| 17TH3A9 | 547638.86 | 3663751.79 | 12.35 | TOP C\L CONC FLDWALL |

**17th Street Canal at Hammond Hwy.**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 17THA1 | 554649.72 | 3664445.06 | 12.10 | TOP C\L CONC FLDWALL |
| 17THA10 | 554723.08 | 3664404.22 | 14.18 | TOP C\L CONC FLDWALL |
| 17THA11 | 554725.67 | 3664384.31 | 14.33 | TOP C\L CONC FLDWALL |
| 17THA12 | 554731.13 | 3664345.37 | 14.43 | TOP C\L CONC FLDWALL |
| 17THA13 | 554736.20 | 3664306.46 | 13.97 | TOP C\L CONC FLDWALL |
| 17THA14 | 554741.63 | 3664267.53 | 13.10 | TOP C\L CONC FLDWALL |
| 17THA15 | 554744.37 | 3664248.55 | 12.36 | TOP C\L CONC FLDWALL |
| 17THA16 | 554744.41 | 3664247.55 | 12.37 | TOP C\L CONC FLDWALL |
| 17THA17 | 554742.71 | 3664247.50 | 12.33 | TOP C\L CONC FLDWALL |
| 17THA18 | 554742.40 | 3664247.49 | 12.31 | TOP C\L CONC FLDWALL |
| 17THA19 | 554737.36 | 3664247.25 | 12.33 | TOP C\L CONC FLDWALL |
| 17THA2 | 554679.59 | 3664446.77 | 11.92 | TOP C\L CONC FLDWALL |
| 17THA20 | 554729.46 | 3664236.36 | 12.31 | TOP C\L CONC FLDWALL |
| 17THA21 | 554699.23 | 3664235.16 | 12.34 | TOP C\L CONC FLDWALL |
| 17THA22 | 554668.80 | 3664234.00 | 12.39 | TOP C\L CONC FLDWALL |
| 17THA23 | 554922.34 | 3664221.65 | 12.30 | TOP C\L CONC FLDWALL |
| 17THA24 | 554890.32 | 3664216.02 | 12.24 | TOP C\L CONC FLDWALL |
| 17THA25 | 554890.70 | 3664212.19 | 12.26 | TOP C\L CONC FLDWALL |
| 17THA26 | 554866.60 | 3664207.70 | 12.21 | TOP C\L CONC FLDWALL |
| 17THA27 | 554866.31 | 3664207.90 | 12.17 | TOP C\L CONC FLDWALL |
| 17THA28 | 554860.87 | 3664207.04 | 12.16 | TOP C\L CONC FLDWALL |

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|---|---|---|---|---|
| 17THA29 | 554860.04 | 3664211.54 | 12.19 | TOP C\L CONC FLDWALL |
| 17THA3 | 554684.98 | 3664447.07 | 11.89 | TOP C\L CONC FLDWALL |
| 17THA30 | 554859.87 | 3664211.96 | 12.93 | TOP C\L CONC FLDWALL |
| 17THA31 | 554859.58 | 3664213.70 | 12.96 | END CONC FLDWALL |
| 17THA32 | 554856.01 | 3664237.65 | 12.95 | END CONC FLDWALL |
| 17THA33 | 554855.57 | 3664239.44 | 12.93 | TOP C\L CONC FLDWALL |
| 17THA34 | 554855.67 | 3664239.92 | 12.19 | TOP C\L CONC FLDWALL |
| 17THA35 | 554854.72 | 3664246.14 | 12.12 | TOP C\L CONC FLDWALL |
| 17THA36 | 554854.09 | 3664249.47 | 12.16 | TOP C\L CONC FLDWALL |
| 17THA37 | 554828.27 | 3664258.70 | 12.17 | TOP C\L CONC FLDWALL |
| 17THA38 | 554825.24 | 3664258.35 | 12.12 | TOP C\L CONC FLDWALL |
| 17THA39 | 554825.01 | 3664258.21 | 12.21 | TOP C\L CONC FLDWALL |
| 17THA4 | 554713.11 | 3664442.71 | 13.68 | TOP C\L CONC FLDWALL |
| 17THA40 | 554823.81 | 3664258.12 | 12.22 | TOP C\L CONC FLDWALL |
| 17THA41 | 554823.43 | 3664259.31 | 12.19 | TOP C\L CONC FLDWALL |
| 17THA42 | 554818.41 | 3664297.44 | 13.33 | TOP C\L CONC FLDWALL |
| 17THA43 | 554813.05 | 3664336.92 | 14.27 | TOP C\L CONC FLDWALL |
| 17THA44 | 554810.35 | 3664356.52 | 14.28 | TOP C\L CONC FLDWALL |
| 17THA45 | 554805.19 | 3664395.21 | 14.36 | TOP C\L CONC FLDWALL |
| 17THA46 | 554799.64 | 3664434.48 | 13.84 | TOP C\L CONC FLDWALL |
| 17THA47 | 554797.19 | 3664452.70 | 13.35 | TOP C\L CONC FLDWALL |
| 17THA48 | 554797.05 | 3664453.82 | 13.37 | TOP C\L CONC FLDWALL |
| 17THA49 | 554798.32 | 3664454.10 | 13.36 | TOP C\L CONC FLDWALL |
| 17THA5 | 554715.73 | 3664442.85 | 13.20 | TOP C\L CONC FLDWALL |
| 17THA50 | 554798.56 | 3664454.16 | 13.07 | TOP C\L CONC FLDWALL |
| 17THA51 | 554798.73 | 3664453.23 | 13.08 | TOP C\L CONC FLDWALL |
| 17THA52 | 554804.23 | 3664454.48 | 13.05 | TOP C\L CONC FLDWALL |
| 17THA53 | 554822.02 | 3664459.99 | 12.62 | TOP C\L CONC FLDWALL |
| 17THA54 | 554850.77 | 3664469.37 | 12.23 | TOP C\L CONC FLDWALL |
| 17THA55 | 554850.99 | 3664469.76 | 12.26 | TOP C\L CONC FLDWALL |
| 17THA56 | 554851.03 | 3664471.11 | 12.29 | TOP C\L CONC FLDWALL |
| 17THA57 | 554854.47 | 3664471.97 | 12.29 | TOP C\L CONC FLDWALL |
| 17THA58 | 554884.55 | 3664474.19 | 12.34 | TOP C\L CONC FLDWALL |
| 17THA59 | 554856.01 | 3664237.55 | 7.66 | TOE FLDGATE |
| 17THA6 | 554715.65 | 3664443.41 | 13.21 | TOP C\L CONC FLDWALL |
| 17THA60 | 554859.54 | 3664213.89 | 7.69 | TOE FLDGATE |
| 17THA7 | 554715.91 | 3664443.50 | 13.44 | TOP C\L CONC FLDWALL |
| 17THA8 | 554717.52 | 3664443.57 | 13.45 | TOP C\L CONC FLDWALL |
| 17THA9 | 554717.65 | 3664442.55 | 13.44 | TOP C\L CONC FLDWALL |

## London Ave. Canal at Gentilly Blvd.

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| LOND4A1 | 544960.38 | 3681240.02 | 12.80 | TOP C\L CONC FLDWALL |
| LOND4A10 | 544974.91 | 3681347.43 | 12.47 | TOP C\L CONC FLDWALL |
| LOND4A11 | 544975.17 | 3681347.49 | 12.68 | TOP C\L CONC FLDWALL |
| LOND4A12 | 544976.05 | 3681347.29 | 12.88 | TOP C\L CONC FLDWALL |
| LOND4A13 | 544986.66 | 3681338.52 | 12.85 | TOP C\L CONC FLDWALL |
| LOND4A14 | 545018.06 | 3681335.96 | 12.77 | TOP C\L CONC FLDWALL |
| LOND4A15 | 544790.95 | 3681355.19 | 14.20 | TOP C\L CONC FLDWALL |
| LOND4A16 | 544791.03 | 3681355.09 | 13.57 | TOP C\L CONC FLDWALL |

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|---|---|---|---|---|
| LOND4A17 | 544823.05 | 3681352.44 | 12.77 | TOP C\L CONC FLDWALL |
| LOND4A18 | 544862.72 | 3681356.84 | 12.88 | TOP C\L CONC FLDWALL |
| LOND4A19 | 544862.95 | 3681356.66 | 12.44 | TOP C\L CONC FLDWALL |
| LOND4A2 | 544930.77 | 3681242.29 | 12.87 | TOP C\L CONC FLDWALL |
| LOND4A20 | 544868.25 | 3681356.27 | 12.42 | TOP C\L CONC FLDWALL |
| LOND4A21 | 544847.60 | 3681327.06 | 12.41 | TOP C\L CONC FLDWALL |
| LOND4A22 | 544821.86 | 3681291.00 | 12.46 | TOP C\L CONC FLDWALL |
| LOND4A23 | 544800.96 | 3681261.52 | 12.44 | TOP C\L CONC FLDWALL |
| LOND4A24 | 544790.44 | 3681246.65 | 12.51 | TOP C\L CONC FLDWALL |
| LOND4A25 | 544786.14 | 3681246.77 | 12.49 | TOP C\L CONC FLDWALL |
| LOND4A26 | 544785.90 | 3681246.88 | 13.02 | TOP C\L CONC FLDWALL |
| LOND4A27 | 544774.29 | 3681252.02 | 13.04 | TOP C\L CONC FLDWALL |
| LOND4A28 | 544774.10 | 3681252.06 | 12.80 | TOP C\L CONC FLDWALL |
| LOND4A29 | 544764.50 | 3681256.22 | 12.82 | TOP C\L CONC FLDWALL |
| LOND4A3 | 544927.86 | 3681242.25 | 12.81 | TOP C\L CONC FLDWALL |
| LOND4A30 | 544762.11 | 3681256.33 | 12.80 | TOP C\L CONC FLDWALL |
| LOND4A31 | 544761.87 | 3681256.36 | 12.94 | TOP C\L CONC FLDWALL |
| LOND4A32 | 544735.08 | 3681258.50 | 12.92 | TOP C\L CONC FLDWALL |
| LOND4A4 | 544899.48 | 3681237.68 | 12.74 | TOP C\L CONC FLDWALL |
| LOND4A5 | 544899.13 | 3681237.78 | 12.42 | TOP C\L CONC FLDWALL |
| LOND4A6 | 544893.31 | 3681238.27 | 12.40 | TOP C\L CONC FLDWALL |
| LOND4A7 | 544914.01 | 3681267.26 | 12.38 | TOP C\L CONC FLDWALL |
| LOND4A8 | 544944.69 | 3681310.53 | 12.38 | TOP C\L CONC FLDWALL |
| LOND4A9 | 544971.36 | 3681347.83 | 12.32 | TOP C\L CONC FLDWALL |

| **London Ave. Canal at Mirabeau Ave.** | | | | |
|---|---|---|---|---|
| **Name** | **Northing** | **Easting** | **Elevation** | **Code** |
| LOND5A1 | 550552.11 | 3680754.05 | 12.62 | TOP C\L CONC FLDWALL |
| LOND5A10 | 550496.16 | 3680784.98 | 13.24 | TOP C\L CONC FLDWALL |
| LOND5A11 | 550500.94 | 3680844.71 | 13.26 | TOP C\L CONC FLDWALL |
| LOND5A12 | 550504.03 | 3680884.53 | 13.32 | TOP C\L CONC FLDWALL |
| LOND5A13 | 550504.08 | 3680885.93 | 13.36 | TOP C\L CONC FLDWALL |
| LOND5A14 | 550505.16 | 3680885.82 | 13.38 | TOP C\L CONC FLDWALL |
| LOND5A15 | 550505.50 | 3680885.83 | 13.02 | TOP C\L CONC FLDWALL |
| LOND5A16 | 550520.02 | 3680884.31 | 13.00 | END CONC FLDWALL |
| LOND5A17 | 550525.13 | 3680883.99 | 13.00 | END CONC FLDWALL |
| LOND5A18 | 550544.85 | 3680882.37 | 13.04 | TOP C\L CONC FLDWALL |
| LOND5A19 | 550524.99 | 3680883.91 | 4.35 | TOE FLDGATE |
| LOND5A2 | 550518.98 | 3680756.95 | 12.63 | END CONC FLDWALL |
| LOND5A20 | 550520.29 | 3680884.40 | 4.40 | TOE FLDGATE |
| LOND5A21 | 550518.70 | 3680756.77 | 4.17 | TOE FLDGATE |
| LOND5A22 | 550514.01 | 3680757.04 | 4.25 | TOE FLDGATE |
| LOND5A23 | 550391.63 | 3680757.24 | 4.94 | TOE FLDGATE |
| LOND5A24 | 550396.49 | 3680756.93 | 4.98 | TOE FLDGATE |
| LOND5A25 | 550365.57 | 3680759.31 | 12.94 | TOP C\L CONC FLDWALL |
| LOND5A26 | 550391.44 | 3680757.29 | 12.99 | END CONC FLDWALL |
| LOND5A27 | 550396.59 | 3680756.94 | 12.95 | END CONC FLDWALL |
| LOND5A28 | 550417.04 | 3680755.33 | 13.02 | TOP C\L CONC FLDWALL |
| LOND5A29 | 550419.10 | 3680749.11 | 13.02 | TOP C\L CONC FLDWALL |
| LOND5A3 | 550513.76 | 3680757.16 | 12.65 | END CONC FLDWALL |

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|---|---|---|---|---|
| LOND5A30 | 550422.06 | 3680748.81 | 13.07 | TOP C\L CONC FLDWALL |
| LOND5A31 | 550422.45 | 3680748.84 | 13.45 | TOP C\L CONC FLDWALL |
| LOND5A32 | 550423.41 | 3680748.75 | 13.39 | TOP C\L CONC FLDWALL |
| LOND5A33 | 550423.80 | 3680750.65 | 13.34 | TOP C\L CONC FLDWALL |
| LOND5A34 | 550423.59 | 3680751.35 | 13.39 | TOP C\L CONC FLDWALL |
| LOND5A35 | 550426.75 | 3680790.93 | 13.36 | TOP C\L CONC FLDWALL |
| LOND5A36 | 550431.48 | 3680850.39 | 13.33 | TOP C\L CONC FLDWALL |
| LOND5A37 | 550434.74 | 3680890.16 | 13.35 | TOP C\L CONC FLDWALL |
| LOND5A38 | 550434.76 | 3680891.29 | 13.33 | TOP C\L CONC FLDWALL |
| LOND5A39 | 550433.40 | 3680891.50 | 13.32 | TOP C\L CONC FLDWALL |
| LOND5A4 | 550510.19 | 3680757.03 | 12.66 | TOP C\L CONC FLDWALL |
| LOND5A40 | 550433.03 | 3680891.51 | 12.76 | TOP C\L CONC FLDWALL |
| LOND5A41 | 550430.62 | 3680891.76 | 12.77 | TOP C\L CONC FLDWALL |
| LOND5A42 | 550425.66 | 3680887.28 | 12.80 | TOP C\L CONC FLDWALL |
| LOND5A43 | 550409.17 | 3680888.32 | 12.79 | END CONC FLDWALL |
| LOND5A44 | 550403.94 | 3680888.76 | 12.79 | END CONC FLDWALL |
| LOND5A45 | 550370.32 | 3680891.47 | 12.94 | TOP C\L CONC FLDWALL |
| LOND5A46 | 550404.19 | 3680888.73 | 4.96 | TOE FLDGATE |
| LOND5A47 | 550408.93 | 3680888.43 | 4.98 | TOE FLDGATE |
| LOND5A5 | 550503.91 | 3680743.20 | 12.77 | TOP C\L CONC FLDWALL |
| LOND5A6 | 550494.69 | 3680743.00 | 12.67 | TOP C\L CONC FLDWALL |
| LOND5A7 | 550494.20 | 3680743.17 | 13.34 | TOP C\L CONC FLDWALL |
| LOND5A8 | 550492.59 | 3680743.29 | 13.35 | TOP C\L CONC FLDWALL |
| LOND5A9 | 550492.87 | 3680745.54 | 13.35 | TOP C\L CONC FLDWALL |

**London Ave. Canal at Filmore Ave.**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| LOND6A1 | 552090.97 | 3680621.06 | 13.00 | TOP C\L CONC FLDWALL |
| LOND6A10 | 552035.64 | 3680687.20 | 13.24 | TOP C\L CONC FLDWALL |
| LOND6A11 | 552041.69 | 3680763.08 | 13.25 | TOP C\L CONC FLDWALL |
| LOND6A12 | 552041.74 | 3680764.18 | 13.22 | TOP C\L CONC FLDWALL |
| LOND6A13 | 552043.23 | 3680764.13 | 13.27 | TOP C\L CONC FLDWALL |
| LOND6A14 | 552043.44 | 3680764.17 | 12.83 | TOP C\L CONC FLDWALL |
| LOND6A15 | 552045.67 | 3680764.14 | 12.86 | TOP C\L CONC FLDWALL |
| LOND6A16 | 552050.90 | 3680757.15 | 12.87 | TOP C\L CONC FLDWALL |
| LOND6A17 | 552058.99 | 3680756.42 | 12.87 | END CONC FLDWALL |
| LOND6A18 | 552064.12 | 3680756.21 | 12.90 | END CONC FLDWALL |
| LOND6A19 | 552090.64 | 3680754.39 | 12.98 | TOP C\L CONC FLDWALL |
| LOND6A2 | 552056.05 | 3680624.27 | 12.91 | END CONC FLDWALL |
| LOND6A20 | 552063.96 | 3680756.27 | 3.96 | TOE FLDGATE |
| LOND6A21 | 552059.28 | 3680756.41 | 3.99 | TOE FLDGATE |
| LOND6A22 | 552040.93 | 3680765.21 | 7.06 | C C FWALL-WALKWAY |
| LOND6A23 | 552028.55 | 3680611.26 | 7.11 | C C FWALL-WALKWAY |
| LOND6A24 | 552055.78 | 3680624.26 | 5.01 | TOE FLDGATE |
| LOND6A25 | 552051.12 | 3680624.70 | 5.05 | TOE FLDGATE |
| LOND6A26 | 551937.65 | 3680625.25 | 4.59 | TOE FLDGATE |
| LOND6A27 | 551942.29 | 3680624.97 | 4.57 | TOE FLDGATE |
| LOND6A28 | 551985.02 | 3680614.76 | 7.04 | C C FWALL-WALKWAY |
| LOND6A29 | 551997.41 | 3680768.59 | 7.08 | C C FWALL-WALKWAY |
| LOND6A3 | 552050.96 | 3680624.69 | 12.92 | END CONC FLDWALL |

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|---|---|---|---|---|
| LOND6A30 | 551953.57 | 3680766.01 | 4.46 | TOE FLDGATE |
| LOND6A31 | 551948.90 | 3680766.42 | 4.44 | TOE FLDGATE |
| LOND6A32 | 551931.00 | 3680767.91 | 12.84 | TOP C\L CONC FLDWALL |
| LOND6A33 | 551948.61 | 3680766.34 | 12.86 | END CONC FLDWALL |
| LOND6A34 | 551953.79 | 3680765.94 | 12.92 | END CONC FLDWALL |
| LOND6A35 | 551962.71 | 3680765.22 | 12.92 | TOP C\L CONC FLDWALL |
| LOND6A36 | 551963.23 | 3680765.06 | 13.72 | TOP C\L CONC FLDWALL |
| LOND6A37 | 551964.94 | 3680765.08 | 13.83 | P\L CROSSING |
| LOND6A38 | 551970.45 | 3680764.65 | 13.83 | P\L CROSSING |
| LOND6A39 | 551972.14 | 3680764.30 | 13.84 | TOP C\L CONC FLDWALL |
| LOND6A4 | 552047.45 | 3680624.88 | 12.85 | TOP C\L CONC FLDWALL |
| LOND6A40 | 551972.67 | 3680764.37 | 13.00 | TOP C\L CONC FLDWALL |
| LOND6A41 | 551986.93 | 3680763.17 | 12.96 | TOP C\L CONC FLDWALL |
| LOND6A42 | 551993.11 | 3680768.25 | 12.98 | TOP C\L CONC FLDWALL |
| LOND6A43 | 551994.76 | 3680768.13 | 12.89 | TOP C\L CONC FLDWALL |
| LOND6A44 | 551994.99 | 3680767.86 | 13.32 | TOP C\L CONC FLDWALL |
| LOND6A45 | 551996.33 | 3680767.69 | 13.32 | TOP C\L CONC FLDWALL |
| LOND6A46 | 551990.07 | 3680690.26 | 13.27 | TOP C\L CONC FLDWALL |
| LOND6A47 | 551984.34 | 3680616.99 | 13.24 | TOP C\L CONC FLDWALL |
| LOND6A48 | 551984.01 | 3680615.75 | 13.23 | TOP C\L CONC FLDWALL |
| LOND6A49 | 551982.72 | 3680615.85 | 13.24 | TOP C\L CONC FLDWALL |
| LOND6A5 | 552032.13 | 3680611.65 | 12.90 | TOP C\L CONC FLDWALL |
| LOND6A50 | 551982.57 | 3680615.80 | 12.95 | TOP C\L CONC FLDWALL |
| LOND6A51 | 551980.85 | 3680615.93 | 13.04 | TOP C\L CONC FLDWALL |
| LOND6A52 | 551974.72 | 3680622.92 | 13.02 | TOP C\L CONC FLDWALL |
| LOND6A53 | 551962.21 | 3680623.53 | 13.03 | TOP C\L CONC FLDWALL |
| LOND6A54 | 551961.71 | 3680623.65 | 13.77 | TOP C\L CONC FLDWALL |
| LOND6A55 | 551959.86 | 3680623.70 | 13.73 | P\L CROSSING |
| LOND6A56 | 551954.67 | 3680624.06 | 13.90 | P\L CROSSING |
| LOND6A57 | 551952.89 | 3680624.14 | 13.76 | TOP C\L CONC FLDWALL |
| LOND6A58 | 551952.43 | 3680624.19 | 12.97 | TOP C\L CONC FLDWALL |
| LOND6A59 | 551942.62 | 3680625.01 | 12.86 | END CONC FLDWALL |
| LOND6A6 | 552031.25 | 3680611.91 | 12.94 | TOP C\L CONC FLDWALL |
| LOND6A60 | 551937.45 | 3680625.29 | 12.90 | END CONC FLDWALL |
| LOND6A61 | 551934.27 | 3680625.40 | 12.93 | TOP C\L CONC FLDWALL |
| LOND6A62 | 551929.76 | 3680635.07 | 13.01 | TOP C\L CONC FLDWALL |
| LOND6A63 | 551898.64 | 3680638.00 | 12.98 | TOP C\L CONC FLDWALL |
| LOND6A7 | 552031.02 | 3680612.00 | 13.28 | TOP C\L CONC FLDWALL |
| LOND6A8 | 552029.63 | 3680612.15 | 13.36 | TOP C\L CONC FLDWALL |
| LOND6A9 | 552029.65 | 3680613.42 | 13.31 | TOP C\L CONC FLDWALL |

**London Ave. Canal at Robert E. Lee Blvd.**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| LOND7A1 | 555394.37 | 3680341.32 | 13.14 | TOP C\L CONC FLDWALL |
| LOND7A10 | 555451.47 | 3680331.19 | 8.80 | TOP GAURDRAIL-BRIDGE |
| LOND7A11 | 555446.05 | 3680330.76 | 8.84 | FLOODGATE |
| LOND7A12 | 555451.65 | 3680330.40 | 8.81 | FLOODGATE |
| LOND7A13 | 555452.00 | 3680330.42 | 6.31 | FLOODGATE |
| LOND7A14 | 555455.64 | 3680330.13 | 6.36 | FLOODGATE |
| LOND7A15 | 555455.95 | 3680330.22 | 5.58 | FLOODGATE |

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|---|---|---|---|---|
| LOND7A16 | 555483.79 | 3680328.02 | 5.57 | FLOODGATE |
| LOND7A17 | 555484.19 | 3680327.89 | 6.32 | FLOODGATE |
| LOND7A18 | 555485.97 | 3680327.75 | 6.32 | FLOODGATE |
| LOND7A19 | 555486.02 | 3680327.77 | 8.82 | FLOODGATE |
| LOND7A2 | 555425.63 | 3680339.34 | 13.13 | TOP C\L CONC FLDWALL |
| LOND7A20 | 555491.93 | 3680327.17 | 8.78 | FLOODGATE |
| LOND7A21 | 555434.51 | 3680495.49 | 9.98 | END CONC FLDWALL |
| LOND7A22 | 555449.02 | 3680498.99 | 9.90 | END CONC FLDWALL |
| LOND7A23 | 555449.84 | 3680498.10 | 9.95 | END CONC FLDWALL |
| LOND7A24 | 555464.18 | 3680511.30 | 9.97 | END CONC FLDWALL |
| LOND7A25 | 555460.56 | 3680512.82 | 7.98 | FLOODGATE |
| LOND7A26 | 555466.35 | 3680512.44 | 7.93 | FLOODGATE |
| LOND7A27 | 555466.71 | 3680512.42 | 5.50 | FLOODGATE |
| LOND7A28 | 555470.33 | 3680512.17 | 5.48 | FLOODGATE |
| LOND7A29 | 555470.47 | 3680511.99 | 4.79 | FLOODGATE |
| LOND7A3 | 555425.98 | 3680341.27 | 13.10 | TOP C\L CONC FLDWALL |
| LOND7A30 | 555498.39 | 3680510.00 | 4.79 | FLOODGATE |
| LOND7A31 | 555498.67 | 3680510.01 | 5.49 | FLOODGATE |
| LOND7A32 | 555500.38 | 3680509.63 | 5.48 | FLOODGATE |
| LOND7A33 | 555500.45 | 3680509.59 | 7.96 | FLOODGATE |
| LOND7A34 | 555506.18 | 3680509.13 | 7.96 | FLOODGATE |
| LOND7A35 | 555503.93 | 3680508.58 | 7.96 | END CONC FLDWALL |
| LOND7A36 | 555503.91 | 3680508.44 | 9.82 | END CONC FLDWALL |
| LOND7A37 | 555503.52 | 3680504.89 | 9.85 | TOP C\L CONC FLDWALL |
| LOND7A38 | 555511.51 | 3680504.22 | 9.83 | TOP C\L CONC FLDWALL |
| LOND7A39 | 555512.80 | 3680516.88 | 9.88 | TOP C\L CONC FLDWALL |
| LOND7A4 | 555428.83 | 3680341.36 | 13.08 | TOP C\L CONC FLDWALL |
| LOND7A40 | 555528.72 | 3680515.71 | 9.78 | TOP C\L CONC FLDWALL |
| LOND7A41 | 555529.18 | 3680516.22 | 13.01 | TOP C\L CONC FLDWALL |
| LOND7A42 | 555535.80 | 3680515.72 | 13.00 | TOP C\L CONC FLDWALL |
| LOND7A43 | 555571.28 | 3680512.73 | 12.97 | TOP C\L CONC FLDWALL |
| LOND7A5 | 555429.12 | 3680341.28 | 9.94 | TOP C\L CONC FLDWALL |
| LOND7A6 | 555436.78 | 3680340.85 | 9.97 | TOP C\L CONC FLDWALL |
| LOND7A7 | 555436.94 | 3680341.97 | 9.95 | TOP C\L CONC FLDWALL |
| LOND7A8 | 555440.53 | 3680341.41 | 9.95 | TOP C\L CONC FLDWALL |
| LOND7A9 | 555450.65 | 3680331.54 | 9.81 | END CONC FLDWALL |

**London Ave. Canal at Leon C. Simon Drive**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| LOND8A1 | 556362.19 | 3680531.22 | 12.90 | END CONC FLDWALL |
| LOND8A10 | 556228.52 | 3680379.18 | 12.44 | TOP C\L CONC FLDWALL |
| LOND8A11 | 556217.64 | 3680340.00 | 12.44 | TOP C\L CONC FLDWALL |
| LOND8A12 | 556207.88 | 3680304.81 | 12.42 | TOP C\L CONC FLDWALL |
| LOND8A13 | 556201.41 | 3680281.60 | 12.44 | TOP C\L CONC FLDWALL |
| LOND8A14 | 556206.55 | 3680281.03 | 12.49 | TOP C\L CONC FLDWALL |
| LOND8A15 | 556206.80 | 3680281.28 | 13.01 | TOP C\L CONC FLDWALL |
| LOND8A16 | 556209.34 | 3680280.93 | 12.92 | TOP C\L CONC FLDWALL |
| LOND8A17 | 556224.99 | 3680260.48 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A18 | 556249.39 | 3680228.20 | 12.92 | TOP C\L CONC FLDWALL |
| LOND8A19 | 556267.12 | 3680204.96 | 12.99 | TOP C\L CONC FLDWALL |

| | | | | |
|---|---|---|---|---|
| LOND8A2 | 556356.79 | 3680532.56 | 13.00 | TOP C\L CONC FLDWALL |
| LOND8A20 | 556273.13 | 3680202.96 | 12.92 | END CONC FLDWALL |
| LOND8A21 | 556071.04 | 3680272.91 | 12.98 | TOP C\L CONC FLDWALL |
| LOND8A22 | 556090.82 | 3680290.48 | 12.94 | TOP C\L CONC FLDWALL |
| LOND8A23 | 556114.98 | 3680288.87 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A24 | 556115.23 | 3680288.67 | 12.40 | TOP C\L CONC FLDWALL |
| LOND8A25 | 556120.31 | 3680288.08 | 12.38 | TOP C\L CONC FLDWALL |
| LOND8A26 | 556129.36 | 3680320.72 | 12.38 | TOP C\L CONC FLDWALL |
| LOND8A27 | 556149.49 | 3680392.87 | 12.40 | TOP C\L CONC FLDWALL |
| LOND8A28 | 556162.91 | 3680441.00 | 12.38 | TOP C\L CONC FLDWALL |
| LOND8A29 | 556169.97 | 3680466.62 | 12.41 | TOP C\L CONC FLDWALL |
| LOND8A3 | 556319.58 | 3680504.13 | 12.90 | TOP C\L CONC FLDWALL |
| LOND8A30 | 556165.87 | 3680466.96 | 12.46 | TOP C\L CONC FLDWALL |
| LOND8A31 | 556165.55 | 3680466.89 | 12.92 | TOP C\L CONC FLDWALL |
| LOND8A32 | 556162.39 | 3680466.89 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A33 | 556159.84 | 3680466.77 | 12.90 | END CONC FLDWALL |
| LOND8A34 | 556154.95 | 3680465.16 | 12.90 | END CONC FLDWALL |
| LOND8A35 | 556152.41 | 3680464.19 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A36 | 556111.21 | 3680467.75 | 12.92 | TOP C\L CONC FLDWALL |
| LOND8A37 | 556155.23 | 3680465.31 | 5.01 | TOP C\L CONC FLDWALL |
| LOND8A38 | 556159.60 | 3680466.69 | 4.98 | TOP C\L CONC FLDWALL |
| LOND8A39 | 556171.17 | 3680467.45 | 6.42 | C C FWALL-BRIDGEBED |
| LOND8A4 | 556287.63 | 3680479.60 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A40 | 556121.00 | 3680287.20 | 6.81 | C C FWALL-BRIDGEBED |
| LOND8A41 | 556200.30 | 3680280.86 | 6.93 | C C FWALL-BRIDGEBED |
| LOND8A42 | 556250.44 | 3680460.82 | 6.49 | C C FWALL-BRIDGEBED |
| LOND8A5 | 556261.04 | 3680459.19 | 12.87 | TOP C\L CONC FLDWALL |
| LOND8A6 | 556256.00 | 3680459.45 | 12.91 | TOP C\L CONC FLDWALL |
| LOND8A7 | 556255.64 | 3680459.46 | 12.39 | TOP C\L CONC FLDWALL |
| LOND8A8 | 556251.11 | 3680460.02 | 12.47 | TOP C\L CONC FLDWALL |
| LOND8A9 | 556240.90 | 3680423.59 | 12.45 | TOP C\L CONC FLDWALL |

**Orleans Ave. Canal at Harrison Ave.**

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| ORLEANS2A1 | 548957.47 | 3671091.30 | 13.59 | TOP C\L CONC FLDWALL |
| ORLEANS2A10 | 549030.28 | 3671103.80 | 13.49 | TOP C\L CONC FLDWALL |
| ORLEANS2A11 | 549026.87 | 3671140.82 | 13.46 | TOP C\L CONC FLDWALL |
| ORLEANS2A12 | 549023.47 | 3671178.86 | 13.52 | TOP C\L CONC FLDWALL |
| ORLEANS2A13 | 549020.07 | 3671215.97 | 13.49 | TOP C\L CONC FLDWALL |
| ORLEANS2A14 | 549016.62 | 3671253.17 | 13.49 | TOP C\L CONC FLDWALL |
| ORLEANS2A15 | 549016.59 | 3671255.41 | 13.41 | TOP C\L CONC FLDWALL |
| ORLEANS2A16 | 549015.30 | 3671254.62 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS2A17 | 549015.04 | 3671254.59 | 13.95 | TOP C\L CONC FLDWALL |
| ORLEANS2A18 | 549012.48 | 3671254.33 | 14.01 | TOP C\L CONC FLDWALL |
| ORLEANS2A19 | 549005.20 | 3671259.99 | 14.03 | END CONC FLDWALL |
| ORLEANS2A2 | 549002.89 | 3671095.47 | 13.63 | TOP C\L CONC FLDWALL |
| ORLEANS2A20 | 549001.11 | 3671263.29 | 14.02 | END CONC FLDWALL |
| ORLEANS2A21 | 548994.98 | 3671268.51 | 14.12 | TOP C\L CONC FLDWALL |
| ORLEANS2A22 | 548991.51 | 3671268.21 | 14.07 | TOP C\L CONC FLDWALL |
| ORLEANS2A23 | 548991.19 | 3671268.17 | 14.02 | TOP C\L CONC FLDWALL |

| | | | | |
|---|---|---|---|---|
| ORLEANS2A24 | 548962.22 | 3671265.37 | 13.96 | TOP C\L CONC FLDWALL |
| ORLEANS2A25 | 549128.77 | 3671280.86 | 13.98 | TOP C\L CONC FLDWALL |
| ORLEANS2A26 | 549087.63 | 3671276.94 | 14.01 | TOP C\L CONC FLDWALL |
| ORLEANS2A27 | 549080.20 | 3671269.83 | 13.99 | END CONC FLDWALL |
| ORLEANS2A28 | 549076.44 | 3671266.23 | 14.06 | END CONC FLDWALL |
| ORLEANS2A29 | 549068.63 | 3671259.38 | 14.03 | TOP C\L CONC FLDWALL |
| ORLEANS2A3 | 549004.27 | 3671095.28 | 13.64 | TOP C\L CONC FLDWALL |
| ORLEANS2A30 | 549065.72 | 3671259.12 | 14.03 | TOP C\L CONC FLDWALL |
| ORLEANS2A31 | 549065.42 | 3671259.13 | 13.51 | TOP C\L CONC FLDWALL |
| ORLEANS2A32 | 549063.50 | 3671258.81 | 13.40 | TOP C\L CONC FLDWALL |
| ORLEANS2A33 | 549064.00 | 3671257.85 | 13.50 | TOP C\L CONC FLDWALL |
| ORLEANS2A34 | 549067.56 | 3671220.56 | 13.53 | TOP C\L CONC FLDWALL |
| ORLEANS2A35 | 549070.85 | 3671183.16 | 13.57 | TOP C\L CONC FLDWALL |
| ORLEANS2A36 | 549074.42 | 3671145.05 | 13.50 | TOP C\L CONC FLDWALL |
| ORLEANS2A37 | 549077.82 | 3671108.27 | 13.48 | TOP C\L CONC FLDWALL |
| ORLEANS2A38 | 549077.40 | 3671107.23 | 13.60 | TOP C\L CONC FLDWALL |
| ORLEANS2A39 | 549079.31 | 3671107.10 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS2A4 | 549004.80 | 3671094.97 | 14.01 | TOP C\L CONC FLDWALL |
| ORLEANS2A40 | 549079.61 | 3671107.12 | 14.08 | TOP C\L CONC FLDWALL |
| ORLEANS2A41 | 549081.10 | 3671107.33 | 14.02 | TOP C\L CONC FLDWALL |
| ORLEANS2A42 | 549099.76 | 3671103.68 | 14.01 | TOP C\L CONC FLDWALL |
| ORLEANS2A43 | 549103.05 | 3671103.96 | 14.10 | TOP C\L CONC FLDWALL |
| ORLEANS2A44 | 549103.71 | 3671104.71 | 13.22 | TOP C\L CONC FLDWALL |
| ORLEANS2A45 | 549113.88 | 3671105.75 | 13.19 | TOP C\L CONC FLDWALL |
| ORLEANS2A46 | 549139.80 | 3671108.04 | 13.24 | TOP C\L CONC FLDWALL |
| ORLEANS2A47 | 549080.03 | 3671269.67 | 6.77 | TOE FLDGATE |
| ORLEANS2A48 | 549076.54 | 3671266.35 | 6.70 | TOE FLDGATE |
| ORLEANS2A49 | 549001.17 | 3671263.18 | 6.58 | TOE FLDGATE |
| ORLEANS2A5 | 549007.66 | 3671095.18 | 14.07 | TOP C\L CONC FLDWALL |
| ORLEANS2A50 | 549005.06 | 3671260.04 | 6.62 | TOE FLDGATE |
| ORLEANS2A6 | 549026.56 | 3671102.15 | 13.99 | TOP C\L CONC FLDWALL |
| ORLEANS2A7 | 549028.44 | 3671102.41 | 13.96 | TOP C\L CONC FLDWALL |
| ORLEANS2A8 | 549028.74 | 3671102.56 | 13.39 | TOP C\L CONC FLDWALL |
| ORLEANS2A9 | 549030.73 | 3671102.82 | 13.47 | TOP C\L CONC FLDWALL |
| ORLEANS3A1 | 551861.15 | 3671526.17 | 13.60 | TOP C\L CONC FLDWALL |
| ORLEANS3A10 | 551801.67 | 3671526.70 | 13.44 | TOP C\L CONC FLDWALL |
| ORLEANS3A11 | 551805.61 | 3671483.50 | 13.05 | TOP C\L CONC FLDWALL |
| ORLEANS3A12 | 551808.82 | 3671448.29 | 13.29 | TOP C\L CONC FLDWALL |
| ORLEANS3A13 | 551811.58 | 3671417.45 | 13.27 | TOP C\L CONC FLDWALL |
| ORLEANS3A14 | 551815.53 | 3671374.70 | 13.25 | TOP C\L CONC FLDWALL |
| ORLEANS3A15 | 551817.55 | 3671352.97 | 13.35 | TOP C\L CONC FLDWALL |
| ORLEANS3A16 | 551819.00 | 3671351.99 | 13.32 | TOP C\L CONC FLDWALL |
| ORLEANS3A17 | 551819.42 | 3671352.00 | 13.88 | TOP C\L CONC FLDWALL |
| ORLEANS3A18 | 551829.93 | 3671353.48 | 13.84 | TOP C\L CONC FLDWALL |
| ORLEANS3A19 | 551830.60 | 3671353.01 | 13.36 | TOP C\L CONC FLDWALL |
| ORLEANS3A2 | 551833.35 | 3671523.39 | 13.64 | TOP C\L CONC FLDWALL |
| ORLEANS3A20 | 551831.66 | 3671354.28 | 12.61 | TOP C\L CONC FLDWALL |
| ORLEANS3A21 | 551867.31 | 3671357.48 | 13.24 | TOP C\L CONC FLDWALL |
| ORLEANS3A22 | 551893.43 | 3671359.95 | 12.99 | TOP C\L CONC FLDWALL |
| ORLEANS3A23 | 551708.91 | 3671343.03 | 13.26 | TOP C\L CONC FLDWALL |
| ORLEANS3A24 | 551743.27 | 3671346.29 | 13.28 | TOP C\L CONC FLDWALL |

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|---|---|---|---|---|
| ORLEANS3A25 | 551745.07 | 3671345.07 | 13.47 | TOP C\L CONC FLDWALL |
| ORLEANS3A26 | 551745.53 | 3671345.68 | 13.78 | TOP C\L CONC FLDWALL |
| ORLEANS3A27 | 551768.39 | 3671347.35 | 13.86 | TOP C\L CONC FLDWALL |
| ORLEANS3A28 | 551768.65 | 3671347.50 | 13.41 | TOP C\L CONC FLDWALL |
| ORLEANS3A29 | 551770.74 | 3671347.86 | 13.39 | TOP C\L CONC FLDWALL |
| ORLEANS3A3 | 551821.14 | 3671522.02 | 13.66 | TOP C\L CONC FLDWALL |
| ORLEANS3A30 | 551770.19 | 3671348.63 | 13.28 | TOP C\L CONC FLDWALL |
| ORLEANS3A31 | 551768.21 | 3671369.89 | 13.30 | TOP C\L CONC FLDWALL |
| ORLEANS3A32 | 551766.19 | 3671391.65 | 13.39 | TOP C\L CONC FLDWALL |
| ORLEANS3A33 | 551762.10 | 3671435.59 | 13.36 | TOP C\L CONC FLDWALL |
| ORLEANS3A34 | 551758.17 | 3671478.54 | 13.38 | TOP C\L CONC FLDWALL |
| ORLEANS3A35 | 551754.28 | 3671521.91 | 13.45 | TOP C\L CONC FLDWALL |
| ORLEANS3A36 | 551754.60 | 3671523.12 | 13.44 | TOP C\L CONC FLDWALL |
| ORLEANS3A37 | 551752.57 | 3671523.17 | 13.45 | TOP C\L CONC FLDWALL |
| ORLEANS3A38 | 551752.16 | 3671523.22 | 13.92 | TOP C\L CONC FLDWALL |
| ORLEANS3A39 | 551747.74 | 3671523.05 | 13.99 | TOP C\L CONC FLDWALL |
| ORLEANS3A4 | 551818.94 | 3671522.74 | 13.61 | END CONC FLDWALL |
| ORLEANS3A40 | 551740.40 | 3671523.81 | 13.95 | END CONC FLDWALL |
| ORLEANS3A41 | 551735.23 | 3671524.45 | 14.04 | END CONC FLDWALL |
| ORLEANS3A42 | 551726.36 | 3671525.68 | 14.06 | TOP C\L CONC FLDWALL |
| ORLEANS3A43 | 551722.82 | 3671525.28 | 14.03 | TOP C\L CONC FLDWALL |
| ORLEANS3A44 | 551694.45 | 3671522.50 | 13.90 | TOP C\L CONC FLDWALL |
| ORLEANS3A45 | 551665.82 | 3671519.92 | 13.95 | TOP C\L CONC FLDWALL |
| ORLEANS3A46 | 551735.32 | 3671524.31 | 4.67 | TOE FLDGATE |
| ORLEANS3A47 | 551740.22 | 3671523.82 | 4.65 | TOE FLDGATE |
| ORLEANS3A48 | 551814.39 | 3671524.83 | 4.11 | TOE FLDGATE |
| ORLEANS3A49 | 551818.91 | 3671522.87 | 4.20 | TOE FLDGATE |
| ORLEANS3A5 | 551814.22 | 3671524.78 | 13.59 | END CONC FLDWALL |
| ORLEANS3A50 | 551800.91 | 3671528.65 | 4.28 | C C FWALL-BRIDGEBED |
| ORLEANS3A51 | 551817.25 | 3671350.91 | 5.43 | C C FWALL-BRIDGEBED |
| ORLEANS3A52 | 551770.91 | 3671346.65 | 5.49 | C C FWALL-BRIDGEBED |
| ORLEANS3A53 | 551754.73 | 3671524.36 | 4.31 | C C FWALL-BRIDGEBED |
| ORLEANS3A54 | 551762.52 | 3671435.33 | 7.68 | BASE FLDWALL-BRIDGEBED |
| ORLEANS3A55 | 551808.63 | 3671445.30 | 7.69 | BASE FLDWALL-BRIDGEBED |
| ORLEANS3A6 | 551806.83 | 3671528.22 | 13.60 | TOP C\L CONC FLDWALL |
| ORLEANS3A7 | 551806.49 | 3671528.10 | 13.56 | TOP C\L CONC FLDWALL |
| ORLEANS3A8 | 551803.53 | 3671528.01 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS3A9 | 551803.25 | 3671527.87 | 13.42 | TOP C\L CONC FLDWALL |

## Orleans Ave. Canal at Robert E. Lee Blvd.

| Name | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| ORLEANS4A1 | 554609.32 | 3671837.83 | 13.32 | END CONC FLDWALL |
| ORLEANS4A10 | 554486.57 | 3671688.71 | 13.11 | TOP C\L CONC FLDWALL |
| ORLEANS4A11 | 554489.82 | 3671633.22 | 13.17 | TOP C\L CONC FLDWALL |
| ORLEANS4A12 | 554492.05 | 3671596.92 | 13.13 | TOP C\L CONC FLDWALL |
| ORLEANS4A13 | 554492.76 | 3671597.03 | 13.13 | TOP C\L CONC FLDWALL |
| ORLEANS4A14 | 554492.99 | 3671597.03 | 13.53 | TOP C\L CONC FLDWALL |
| ORLEANS4A15 | 554495.48 | 3671597.15 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS4A16 | 554523.74 | 3671565.89 | 13.52 | TOP C\L CONC FLDWALL |
| ORLEANS4A17 | 554584.12 | 3671572.39 | 13.43 | TOP C\L CONC FLDWALL |

| | | | | |
|---|---|---|---|---|
| ORLEANS4A18 | 554611.36 | 3671575.31 | 13.44 | TOP C\L CONC FLDWALL |
| ORLEANS4A19 | 554658.06 | 3671548.08 | 13.44 | TOP C\L CONC FLDWALL |
| ORLEANS4A2 | 554598.02 | 3671835.82 | 13.27 | TOP C\L CONC FLDWALL |
| ORLEANS4A20 | 554669.50 | 3671548.11 | 13.45 | END CONC FLDWALL |
| ORLEANS4A21 | 554312.50 | 3671750.39 | 13.61 | TOP C\L CONC FLDWALL |
| ORLEANS4A22 | 554340.80 | 3671752.83 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS4A23 | 554369.03 | 3671755.41 | 13.55 | TOP C\L CONC FLDWALL |
| ORLEANS4A24 | 554369.34 | 3671755.42 | 13.60 | TOP C\L CONC FLDWALL |
| ORLEANS4A25 | 554374.79 | 3671756.00 | 13.61 | TOP C\L CONC FLDWALL |
| ORLEANS4A26 | 554404.30 | 3671731.18 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS4A27 | 554407.41 | 3671730.71 | 13.46 | TOP C\L CONC FLDWALL |
| ORLEANS4A28 | 554407.94 | 3671730.73 | 13.05 | TOP C\L CONC FLDWALL |
| ORLEANS4A29 | 554408.45 | 3671730.25 | 13.15 | TOP C\L CONC FLDWALL |
| ORLEANS4A3 | 554569.28 | 3671801.13 | 13.31 | TOP C\L CONC FLDWALL |
| ORLEANS4A30 | 554409.74 | 3671707.03 | 13.08 | TOP C\L CONC FLDWALL |
| ORLEANS4A31 | 554412.48 | 3671660.96 | 13.08 | TOP C\L CONC FLDWALL |
| ORLEANS4A32 | 554415.19 | 3671615.69 | 13.07 | TOP C\L CONC FLDWALL |
| ORLEANS4A33 | 554416.67 | 3671592.72 | 13.11 | TOP C\L CONC FLDWALL |
| ORLEANS4A34 | 554416.13 | 3671592.05 | 13.14 | TOP C\L CONC FLDWALL |
| ORLEANS4A35 | 554415.78 | 3671592.02 | 13.49 | TOP C\L CONC FLDWALL |
| ORLEANS4A36 | 554394.40 | 3671587.30 | 13.40 | TOP C\L CONC FLDWALL |
| ORLEANS4A37 | 554393.35 | 3671588.12 | 13.47 | TOP C\L CONC FLDWALL |
| ORLEANS4A38 | 554360.69 | 3671585.36 | 13.28 | TOP C\L CONC FLDWALL |
| ORLEANS4A39 | 554331.89 | 3671582.80 | 13.38 | TOP C\L CONC FLDWALL |
| ORLEANS4A4 | 554546.65 | 3671773.77 | 13.45 | TOP C\L CONC FLDWALL |
| ORLEANS4A40 | 554483.15 | 3671735.54 | 5.02 | C C FWALL-WALKWAY |
| ORLEANS4A41 | 554491.49 | 3671595.95 | 4.92 | C C FWALL-WALKWAY |
| ORLEANS4A42 | 554417.24 | 3671591.53 | 4.67 | C C FWALL-WALKWAY |
| ORLEANS4A43 | 554409.02 | 3671731.34 | 5.07 | C C FWALL-WALKWAY |
| ORLEANS4A5 | 554503.73 | 3671768.03 | 13.54 | TOP C\L CONC FLDWALL |
| ORLEANS4A6 | 554487.45 | 3671734.85 | 13.52 | TOP C\L CONC FLDWALL |
| ORLEANS4A7 | 554484.66 | 3671734.61 | 13.48 | TOP C\L CONC FLDWALL |
| ORLEANS4A8 | 554484.45 | 3671734.57 | 13.06 | TOP C\L CONC FLDWALL |
| ORLEANS4A9 | 554483.89 | 3671734.55 | 13.07 | TOP C\L CONC FLDWALL |

# Appendix 22
# Orleans Outfall Canal BM ALCO to CHRYSLER Level Run

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

**See field book for observations.**

| | | Field Book Reference | |
|---|---|---|---|
| **Location** | **Elevation** | **Book** | **Page** |
| Buick 1931 | 5.52 | 060854 | 36 |
| Chrysler 1931 | 6.30 | 060854 | 36 |
| Chrysler RM 1 | 6.38 | 060854 | 36 |

# Appendix 23
# Permanent and Temporary Control Used and Established for IPET Surveys

**Horizontal Datum: NAD 1983(1992)**
**Horizontal Coordinate System: U.S. State Plane, 1983, Zone: Louisiana South 1702**
**Vertical Datum: NAVD88(2004.65)**
**Coordinate Units: US survey feet**
**Distance Units: U.S. survey feet**
**Height Units: U.S. survey feet**

| Name | Northing | Easting | Elev | CODE | LOCATION |
|---|---|---|---|---|---|
| **1703** | 547504.26 | 3664050.38 | 8.19 | TBM | 17TH STREET CANAL/VETERENS |
| **5544** | 553678.12 | 3688613.59 | -7.05 | TBM | OP 5544 ST FERDINAN ST |
| **6422** | 557007.07 | 3687727.80 | -6.04 | TBM | OP EAST SIDE PEOPLES ROAD |
| **A 148** | 543696.09 | 3675283.47 | 5.83 | NGS | OP NGS BENCH MARK |
| **AG 06** | 599773.17 | 3745246.69 | 3.62 | TBM | LITTLE IRISH BAYOU GAGE |
| **AMES** | 494821.62 | 3666213.66 | 5.27 | TBM | AMES PUMP STATION |
| **AP 01** | 560498.73 | 3694700.04 | 0.82 | TBM | LAKE FRONT AIRPORT |
| **BARR** | 495348.68 | 3696427.20 | -4.45 | TBM | WHITNEY/BARATARIA PUMP STA. |
| **BEL1** | 494282.41 | 3697937.75 | -3.42 | TBM | TBM-BELLE CHASSE 1 PUMP STA. |
| **BEL2** | 506086.46 | 3703657.17 | -2.47 | TBM | TBM-BELLE CHASSE 2 PUMP STA. |
| **BLOUNT** | 543352.65 | 3681458.36 | -1.35 | TBM | OP PUMP STATION 03 |
| **BRAI** | 493734.13 | 3732366.65 | 9.32 | TBM | BRAITWAITE PUMP STATION |
| **BYD 7** | 528943.38 | 3727697.07 | -1.68 | TBM | BAYOU DUCLOS PUMP STATION 7 |
| **DWYE** | 554365.02 | 3694988.80 | -5.03 | TBM | OP DWYER PUMP STATION |
| **ELAI** | 548634.83 | 3705210.11 | -0.54 | TBM | ELAINE STREET |
| **EMPI** | 329253.48 | 3831795.94 | -6.52 | NGS | EMPIRE AZ MK 2 |
| **ESSE** | 557818.36 | 3674727.63 | 5.85 | NGS | ESSEX- NGS |
| **ESTE** | 487476.27 | 3681808.09 | -2.31 | TBM | ESTELLE PUMP STATION 2 |
| **G 275** | 651873.89 | 3574804.17 | 5.09 | NGS | NGS BENCH MARK |
| **GAIN** | 349610.13 | 3816909.47 | -8.68 | TBM | GAINARD WOODS PUMP STATION |
| **GPS 1** | 653871.78 | 3595812.81 | 2.84 | TBM | GPS POINT/MANCHAC PASS GAGE |
| **GRAHAM RM** | 559308.98 | 3678375.72 | 6.28 | NGS | See PID:BJ1359 |
| **GRAL** | 305325.00 | 3870979.64 | -5.37 | TBM | GRAND LIARD |
| **GRAN** | 550046.61 | 3718973.00 | 1.59 | TBM | OP GRANT ST PUMP STATION |
| **HARV** | 505250.23 | 3679105.33 | -3.90 | TBM | HARVEY PUMP STATION |
| **HERO** | 488396.57 | 3685856.71 | -4.27 | TBM | HERO PUMP STATION |
| **I010** | 544442.12 | 3665897.65 | -5.21 | TBM | TBM-1=I-10 PUMP STATION |

| Name | Northing | Easting | Elev | CODE | LOCATION |
|---|---|---|---|---|---|
| **JEA 6** | 535492.45 | 3711065.99 | 0.27 | TBM | JEAN LAFITTE PUMP STATION 6 |
| **JP 01** | 553956.53 | 3656765.31 | -3.48 | TBM | JP PUMP STATION 01 |
| **JP 02** | 554576.92 | 3645813.33 | -2.85 | TBM | JP PUMP STATION 02 |
| **JP 03** | 558518.67 | 3633625.18 | -5.40 | TBM | JP PUMP STATION 03 |
| **JP 04** | 560557.95 | 3624734.09 | -4.16 | TBM | JP PUMP STATION 04 |
| **KENN** | 537505.88 | 3614304.60 | 23.95 | NGS | MONUMENT |
| **L 278** | 503313.63 | 3736367.04 | 6.93 | NGS | SBP NGS BENCH MARK |
| **LC 05** | 550482.16 | 3681081.87 | -1.22 | TBM | OP LONDON CANAL |
| **MER 4** | 519711.61 | 3737821.12 | 11.59 | TBM | MERAUX PUMP STATION 4 |
| **MILA** | 355913.12 | 3806431.30 | -5.92 | NGS | MILAN 2 |
| **MONT** | 536942.30 | 3663012.89 | -5.35 | TBM | OP MONTICELLO PS |
| **N 367** | 314850.55 | 3878540.66 | 1.12 | NGS | N 367 |
| **OLLI** | 453118.01 | 3696982.75 | 0.52 | TBM | TBM-OLLIE 2 PUMP STATION |
| **OP 01** | 529999.79 | 3671912.07 | -1.95 | TBM | OP PUMP STATION 01 |
| **OP 02** | 535980.32 | 3676083.47 | -2.40 | TBM | OP PUMP STATION 02 |
| **OP 04** | 553616.66 | 3680819.59 | -5.29 | TBM | OP PUMP STATION 04 |
| **OP 06** | 542568.72 | 3663311.24 | -0.29 | TBM | OP PUMP STATION 06 |
| **OP 07** | 545522.72 | 3671153.35 | 0.29 | TBM | OP PUMP STATION 07 |
| **OP 10** | 564890.96 | 3706240.72 | -3.16 | TBM | OP PUMP STATION 10 |
| **OP 11** | 515417.06 | 3710535.96 | -1.93 | TBM | OP PUMP STATION 11 |
| **OP 13** | 510301.98 | 3704016.54 | -6.48 | TBM | OP PUMP STATION 13 |
| **OP 14** | 569381.39 | 3713316.09 | -2.89 | TBM | OP PUMP STATION 14 |
| **OP 15** | 559459.74 | 3744289.03 | -1.70 | TBM | OP PUMP STATION 15 |
| **OP 16** | 561058.98 | 3699352.98 | -3.60 | TBM | OP PUMP STATION 16 |
| **OP 17** | 542897.98 | 3688637.67 | -2.15 | TBM | OP PUMP STATION 17 |
| **OP 18** | 563738.50 | 3732410.12 | 4.82 | TBM | OP PUMP STATION 18 |
| **ORL 2** | 549012.44 | 3671275.40 | 5.89 | TBM | ORLEANS CANAL |
| **ORL 3** | 551747.14 | 3671584.19 | 1.10 | TBM | ORLEANS CANAL |
| **PLPS** | 551154.68 | 3614550.46 | -6.16 | TBM | PARISH LINE PUMP STATION |
| **PAT 5** | 595878.07 | 3744218.43 | 2.27 | TBM | LIDAR PATCH 5 |
| **PLAN** | 505869.21 | 3701618.75 | -3.32 | TBM | PLANTERS PUMP STATION |
| **PUMP** | 540387.85 | 3696535.34 | 14.14 | NGS | OP NGS STATION MARK |
| **S 188** | 535086.13 | 3630421.59 | 7.71 | NGS | JP NGS BENCH MARK |
| **SEGN** | 510470.50 | 3653146.24 | -1.72 | TBM | BAYOU SEGNETTE STATE PARK |
| **STMY** | 495846.54 | 3768426.83 | 6.82 | TBM | ST MARY PUMP STATION 8 |
| **U 149** | 554506.18 | 3671789.17 | 6.20 | NGS | ORLEANS CANAL |
| **WES 2** | 507612.04 | 3653910.45 | -4.38 | TBM | WESTWEGO PUMP STATION 2 |
| **WEST** | 501577.72 | 3659769.61 | 2.18 | TBM | WESTMINSTER PUMP STATION |
| **1327** | 536441.07 | 3691169.56 | -0.13 | TBM | near 1327 Independence St., New Orleans |
| **2133** | 539506.93 | 3692472.56 | -4.00 | TBM | near int. of Alvar and N. Miro St., New Orleans |
| **2320** | 540667.06 | 3685780.83 | -3.64 | TBM | near 2320 N. Tonti St., New Orleans |
| **2474** | 539003.67 | 3686987.66 | -2.54 | TBM | near 2474 N. Roman St., New Orleans |
| **3144** | 540187.55 | 3690705.56 | -4.79 | TBM | near 3144 Byrne Pl., New Orleans |
| **3200** | 544407.07 | 3690541.04 | -4.94 | TBM | near int. of Benefit and Montegut St., New Orleans |
| **3422** | 544827.19 | 3692077.46 | -4.75 | TBM | near 3422 Pleasure St.., New Orleans |
| **5701** | 553749.62 | 3682797.48 | -4.96 | TBM | near 5701 Pasteur Blvd., New Orleans |
| **A148** | 543696.09 | 3675283.47 | 5.83 | NGS | See PID:AU0429 |
| **WE19** | 550746.22 | 3722193.43 | -0.36 | NGS | near Michoud Substation |
| **110** | 281892.48 | 3909390.04 | 2.93 | TBM | LA 110 |
| **112** | 288195.63 | 3910727.91 | -3.25 | TBM | LA 111/LA112 |
| **113** | 304703.03 | 3898424.58 | -3.34 | TBM | LA 113 |

| Name | Northing | Easting | Elev | CODE | LOCATION |
|---|---|---|---|---|---|
| **114** | 309237.04 | 3894462.65 | -0.91 | TBM | LA 114 |
| **115** | 310042.40 | 3866251.59 | -2.20 | TBM | LA 115 |
| **117** | 314910.18 | 3856557.68 | 0.10 | TBM | LA 116/ LA117 |
| **118** | 316908.70 | 3854106.15 | 0.60 | TBM | LA 118 |
| **119** | 320026.38 | 3842675.69 | -1.58 | TBM | LA 119 |
| **121** | 349013.68 | 3823503.38 | 2.15 | TBM | LA 121 |
| **1494 C** | 393095.68 | 3767088.95 | 1.86 | TBM | WEST POINT A-LA-HACHE GAGE SITE |
| **1602 C** | 388177.25 | 3741375.04 | 0.61 | TBM | LAKE JUDGE PEREZ |
| **1799 B** | 364683.61 | 3696818.11 | 2.66 | TBM | MV PETROLEUM SITE |
| **DUVI** | 301331.85 | 3900803.98 | 0.89 | TBM | DUVIC VENICE PUMP STATION |
| **SUNR** | 318226.21 | 3843740.70 | -0.92 | TBM | SUNRISE 1 & 2 PUMP STATIONS |

# Appendix 24
# Pump Stations Surveyed, Listed by Parish

**Jefferson Parish (details found in Appendix 25)**

Ames
Bayou Segnette
Bonnabel - JP#1
Cousins #1
Cousins #2
Duncan Canal - JP#4
Elmwood Canal - JP#3
Estelle #2
Harvey
Hero
Parish Line
Planters
Suburban - JP#2
Westminster
Westwego #2
Whitney/Barataria

**Orleans Parish (details found in Appendix 26)**

Dwyer Rd.  *Note: No elevations collected; this site under construction.*
Elaine St.
Grant St.
I-10
Monticello (Upper Protection)
OP#01
OP#02
OP#03
OP#04
OP#05
OP#06
OP#07
OP#10 (Citrus)
OP#11
OP#12

OP#13
OP#14 (Jahncke)
OP#15
OP#16 (St. Charles)
OP#17 (Station D)
OP#18 (Maxent)
OP#19
OP#20 (Amid)
Pritchard

**Plaquemines Parish (details found in Appendix 27)**

Barreire
Belair
Belle Chasse #1
Belle Chasse #2
Bellevue
Braithwaite
Diamond
Duvic (Venice)
Gainard Woods
Grand Liard (Buras)
Hayes
Ollie #2
Ollie – Lower
Ollie -- Upper
Pointe A La Hache-East bank
Pointe A La Hache-West bank
Pointe Celeste #1
Pointe Celeste #2
Pointe Celeste (Private)
Scarsdale
Sunrise #1
Sunrise #2
Wilkinson (Private)

**St. Bernard Parish (details found in Appendix 28)**

Bayou Ducros #7
Bayou Villere #3
E.J. Gore #5
Fortification #1
Guichard #2
Jean Lafitte #6
Meraux #4
St. Mary #8

**St. Charles Parish (details found in Appendix 29)**

New Sarpy
Ormond I (Destrehan 1)
Ormond II (Destrehan 2)
Schexnaydre
Trepagnier

# Appendix 25
# Jefferson Parish Pump Stations

**AMES Pump Station**


TBM: AMES


TBM: AMES

Ames Pump Station

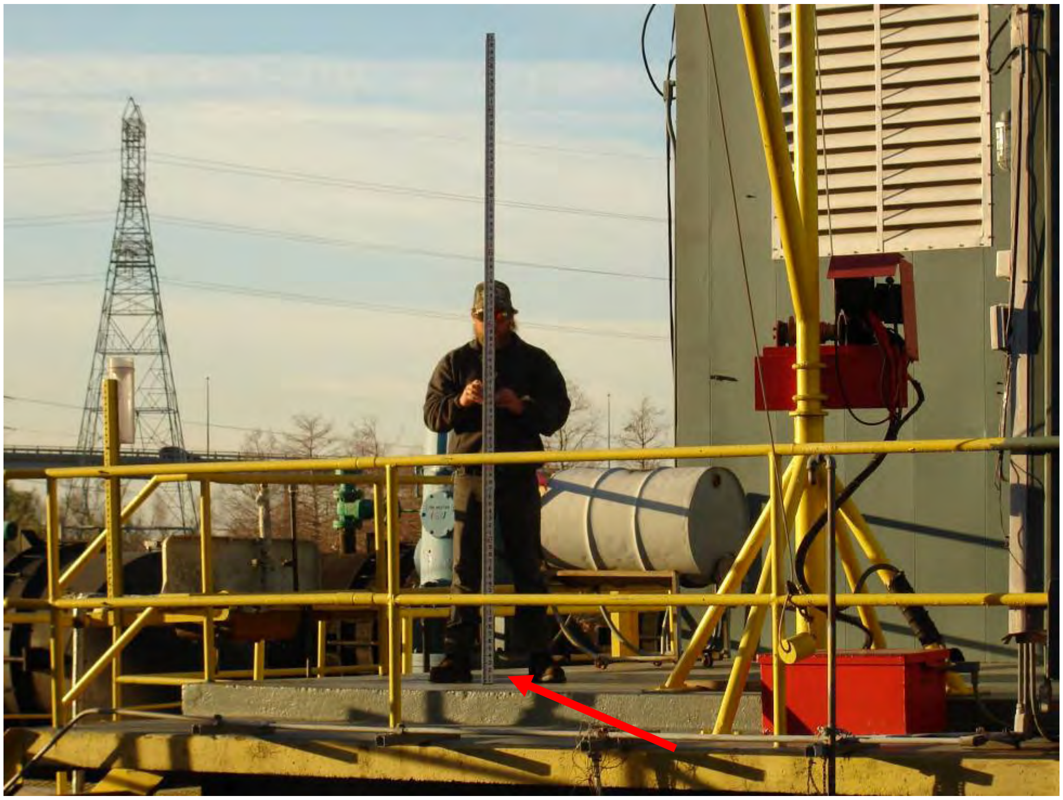
Finished Floor = -7.06 feet NGVD88(2004.65) Field Book 060852

# BAYOU SEGNETTE Pump Station


TBM: SEGN


TBM: SEGN

Finished Floor Bldg #1 = 2.99 Feet NAVD88(2004.65) Field Book 060852



Finished Floor Bldg. #2 = 6.02 feet NAVD88(2004.65) Field Book 060852

# Bonnabel Pump Station – JP 01

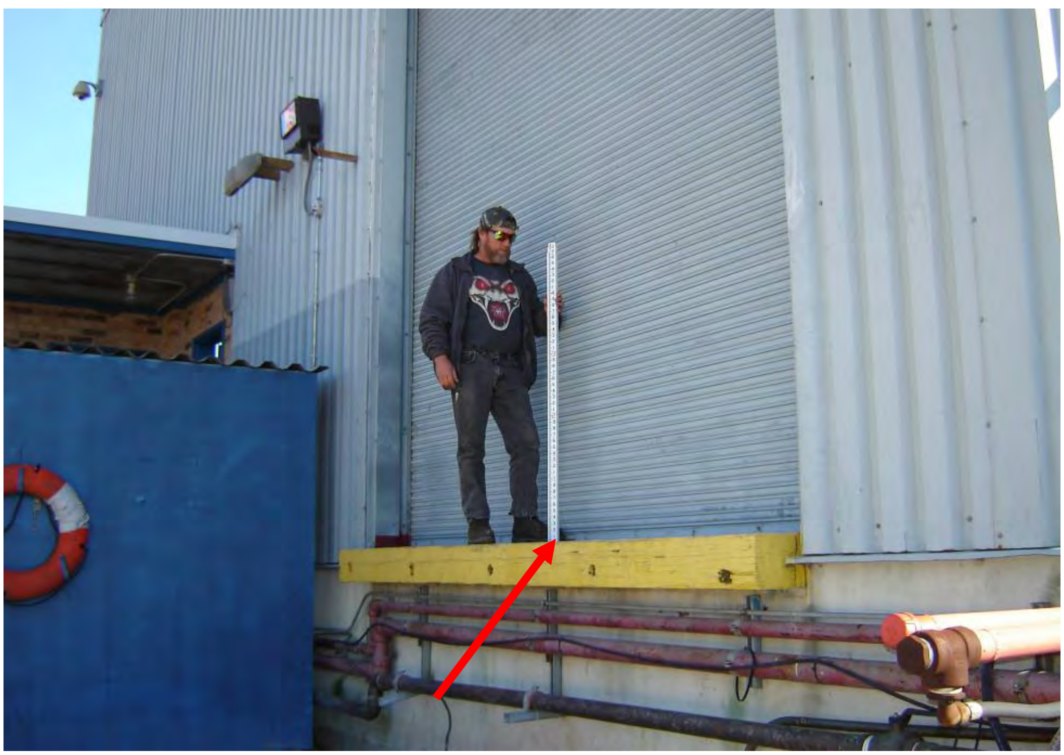
Pump Station JP-01

Finished Floor #1 = 2.87 feet NAVD88(2004.65) Field Book 060852 Page 41

Finished Floor #2 = 3.00 ft NAVD88(2004.65) Field Book 060852  Page 41

## COUSINS #1 Pump Station

Cousins #1 Pump Station



Finished Floor = 2.92 feet NGVD88(2004.65) Field Book 060852

# COUSINS #2 Pump Station

Cousins #2 Pump Station

Finished Floor = 2.11 feet NAVD88(2004.65) Field Book 060852

# Duncan Canal Pump Station --- JP-04

Pump Station JP-04

Finished Floor #1 = 6.20 ft, NAVD 88(2004.65) Bk.060852, Pg. 44

Finished Floor #2 = 2.72 ft, NAVD 88 (2004.65) Bk.060852, Pg. 44

# Elmwood Canal Pump Station   JP-03

Elmwood Canal Pump Station   JP-03

Finished Floor #1 = 5.87 ft, NAVD88(2004.65) Bk.060852, Pg. 43

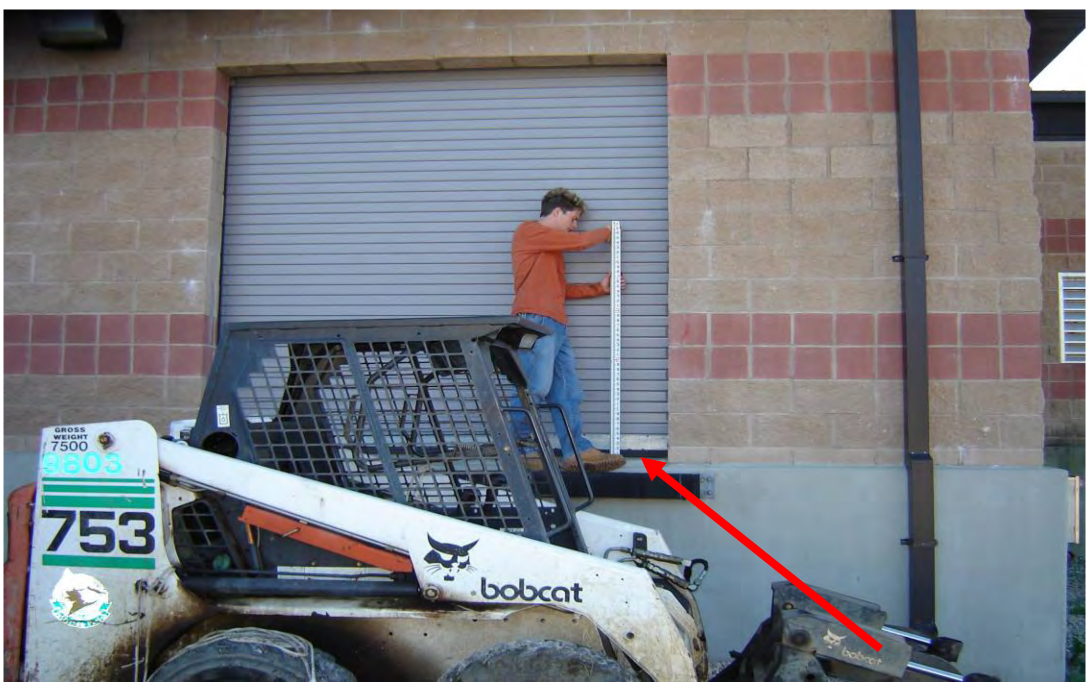

Finished Floor #2 = 4.75 ft, NAVD88(2004.65) Bk.060852, Pg. 43

# ESTELLE #2 Pump Station


TBM: ESTE


TBM: ESTE

Estelle #2 Pump Station



Finished Floor = 2.87 feet NAVD88(2004.65) Field Book 060852

# HARVEY Pump Station

Harvey Pump Station

Finished Floor = 3.15 feet NAVD88(2004.65) Field Book 060852

# HERO Pump Station


TBM: HERO


TBM: HERO

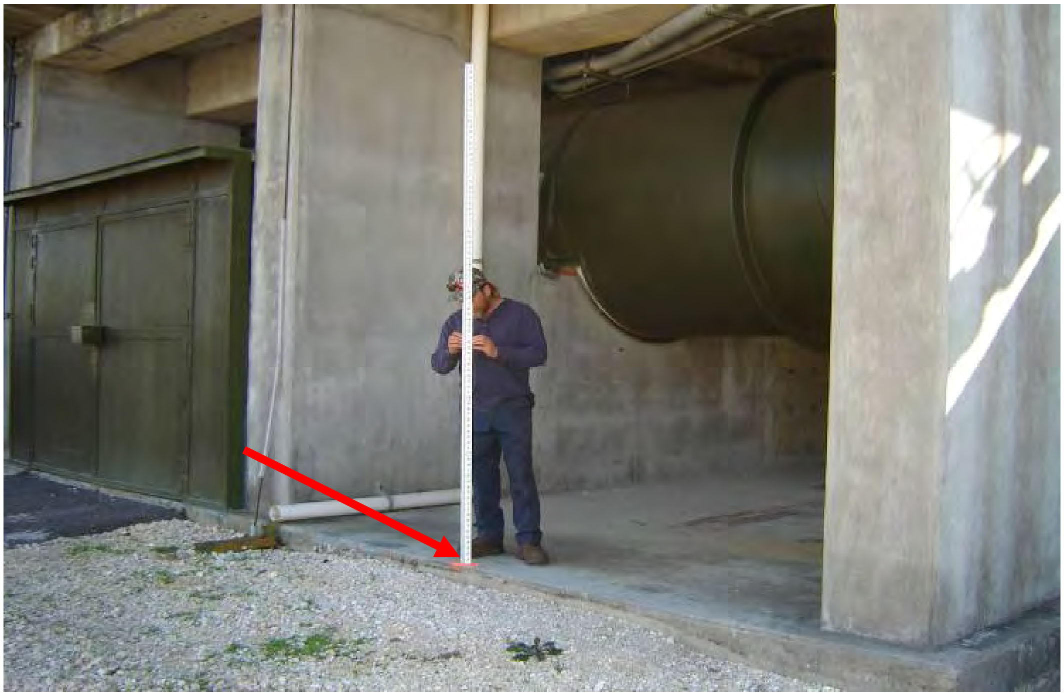
Finished Floor #1 = -.0534 feet NAVD88(2004.65) Field Book 060852

Finished Floor #2 = -0.58 feet NAVD88(2004.65) Field Book 060852

# Parish Line Pump Station

Parish Line Pump Station

Finished Floor #1 = 9.61 ft, NAVD88(2004.65) Bk.060852, Pg. 45



Finished Floor #2 = -5.38 ft, NAVD88(2004.65) Bk.060852, Pg. 45

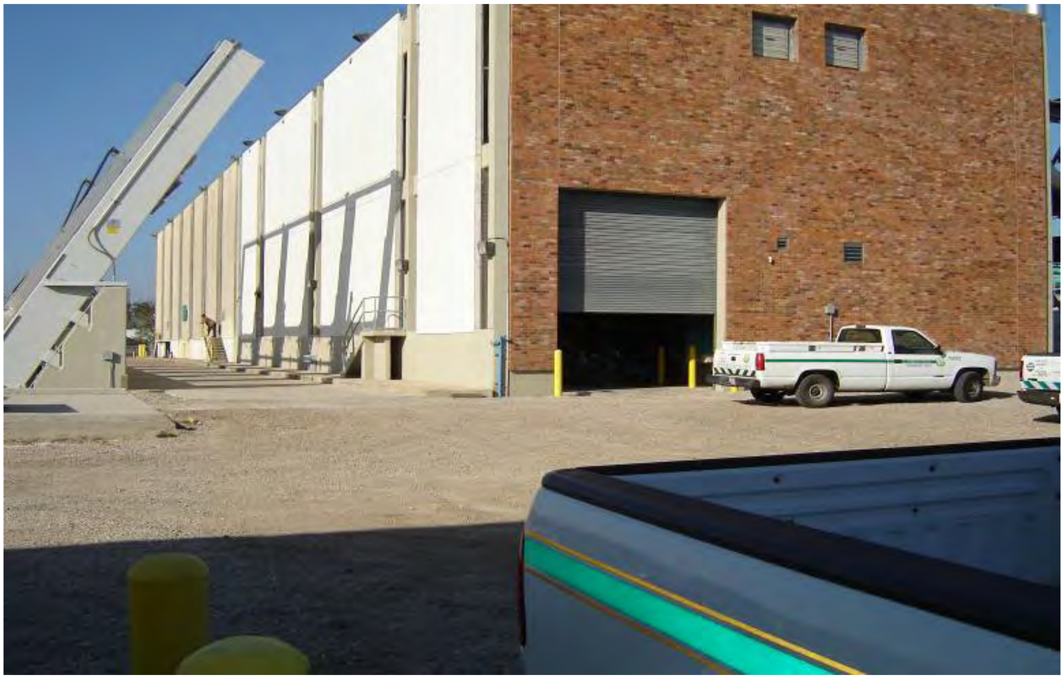
# PLANTERS Pump Station


TBM: PLAN


TBM: PLAN

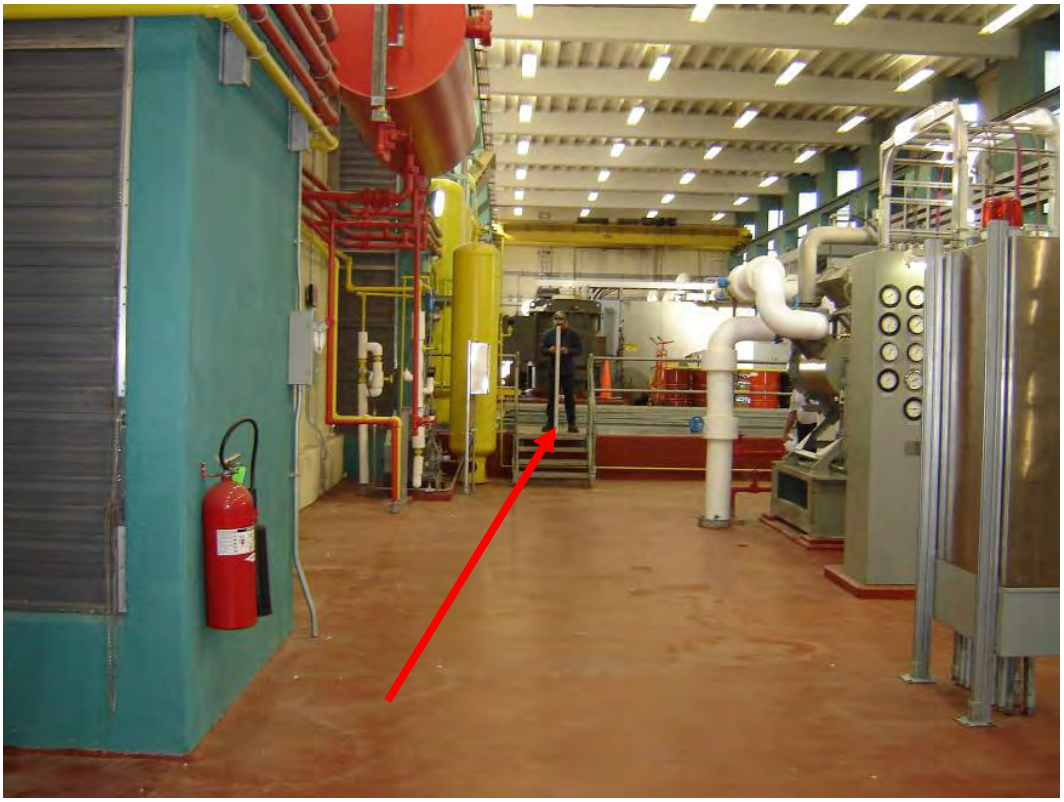
Finished Floor = 1.94 feet NAVD88 (2004.65) Field Book 060852

# Suburban Pump Station JP-02



Pump Station JP-02

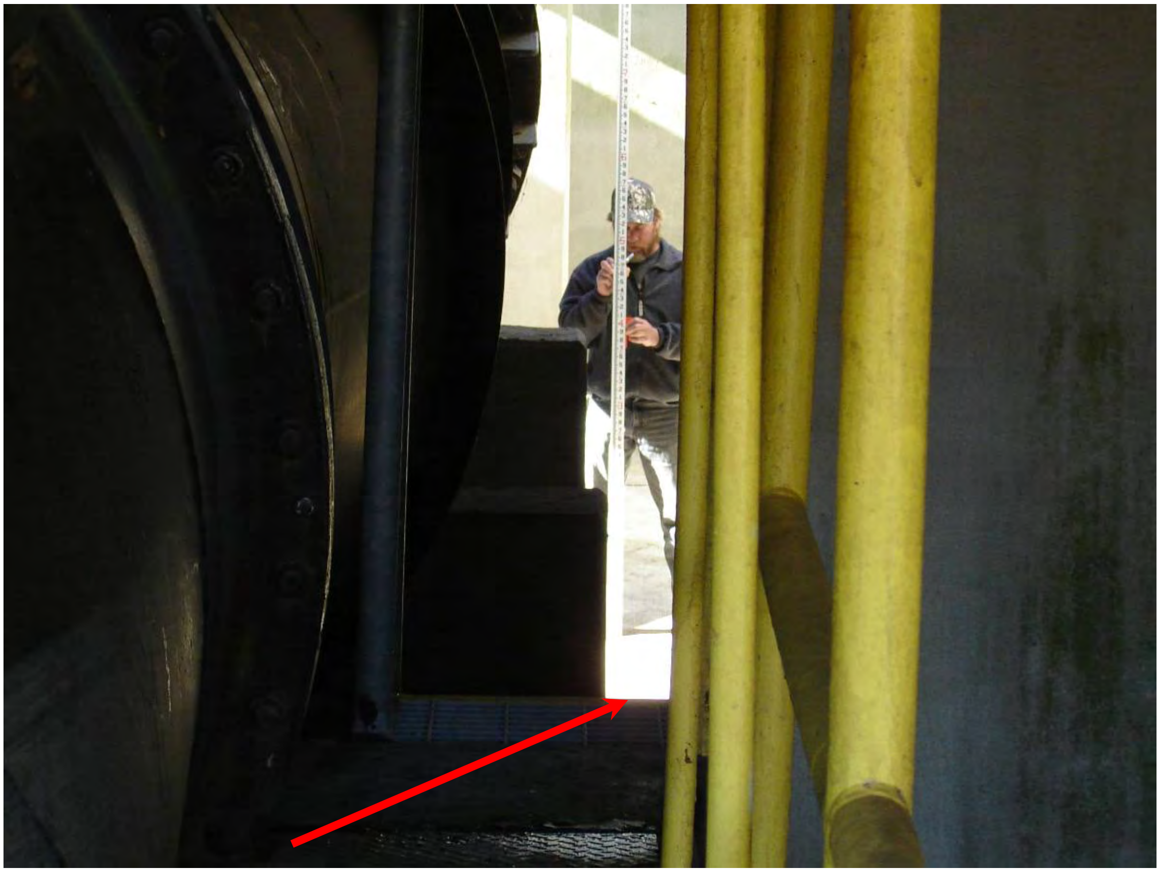
Finished Floor #1 = 3.90 ft, NAVD88(2004.65) Bk.060852, Pg. 42



Finished Floor #2 = 5.96 ft, NAVD88(2004.65) Bk.060852, Pg. 42

# Westminister Pump Station

Westminister Pump Station



Finish Floor = -1.27 feet NAVD88(2004.65) Book # 060852

# WESTWEGO #2 Pump Station


TBM: WES2

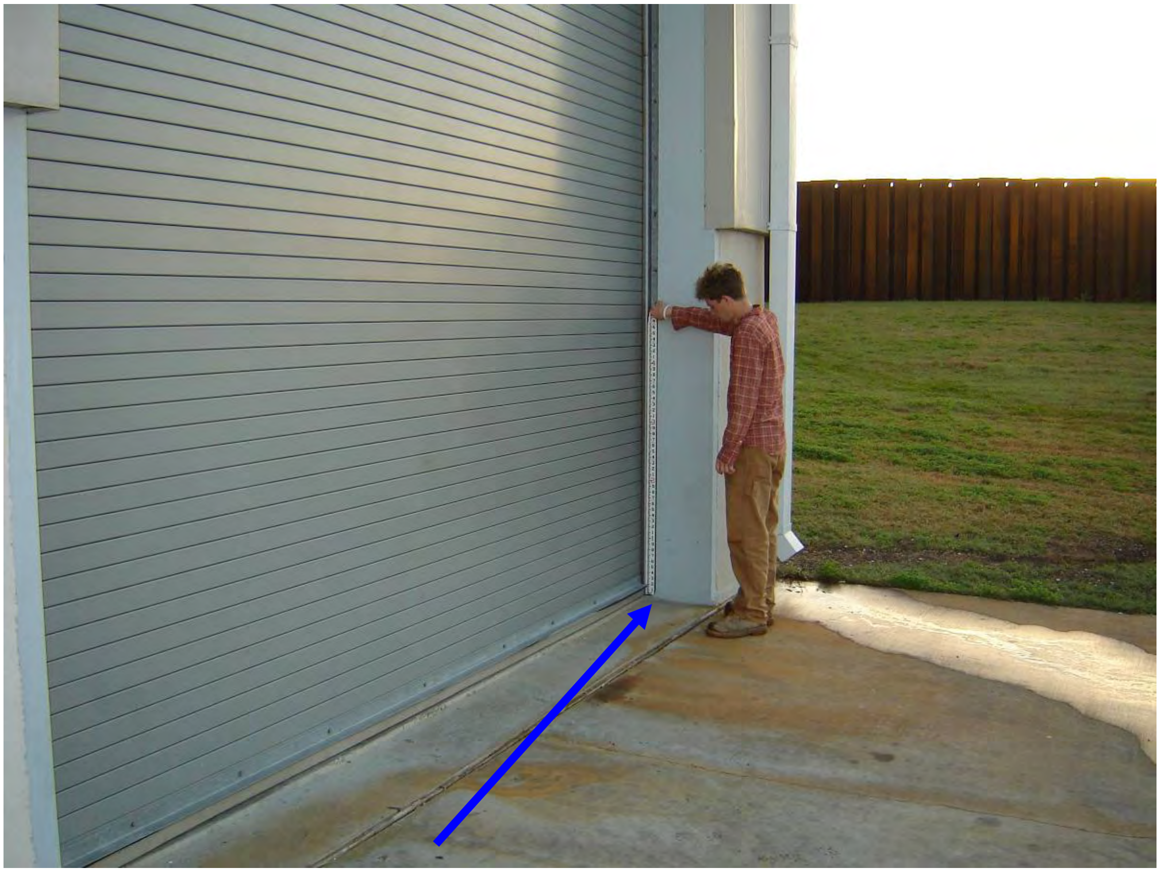

TBM: WES2

Westwego #2 Pump Station

Finished Floor = -4.26 feet NAVD88(2004.65) Field Book 060852

# Whitney\Barataria Pump Station

Whitney-Barataria Pump Station



Finished Floor = -3.02 feet NAVD88(2004.65) Book # 060852

# Appendix 26
# Orleans Parish Pump Stations

**Elaine Street Pump Station**


Elaine #1 = 1.82 feet NAVD88(2004.65) Field Book 060851

# Grant Street Pump Station


TBM: GRAN

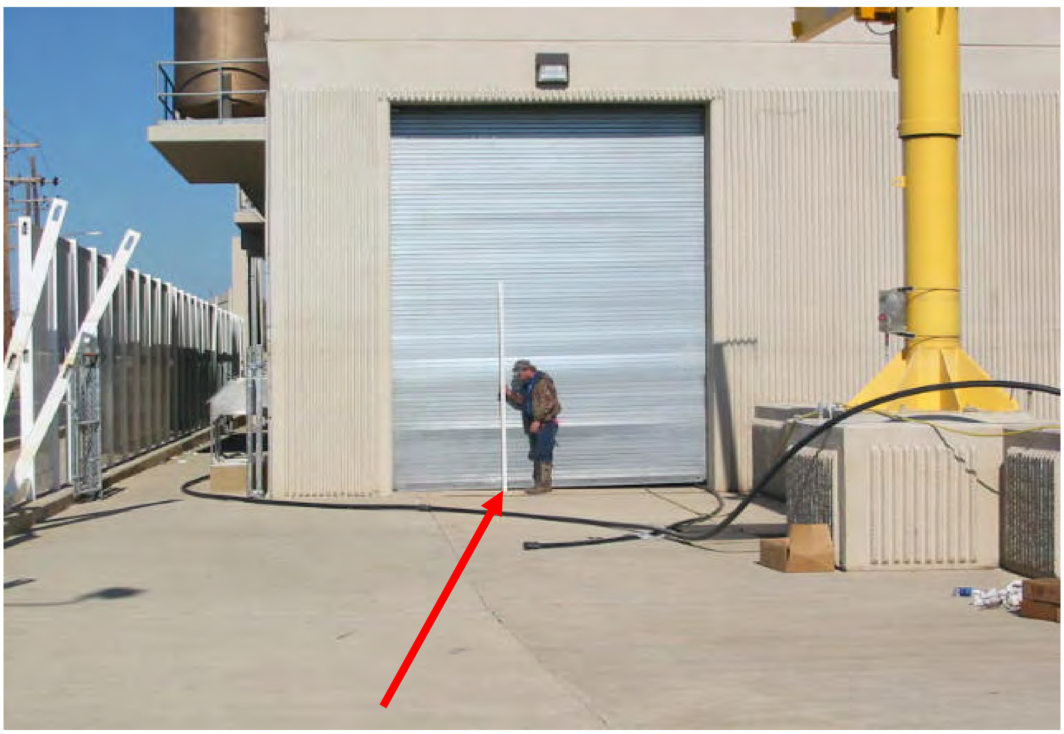
Finished Floor = 5.68 feet NAVD88(2004.65) Field Book 060851 Page 47

# I -10 Pump Station


TBM: I010

I-10 Pump Station


Finished Floor #1 = -11.60 feet NAVD88(2004.65) Field Book 060852


Finished Floor #2 = -4.10 feet NAVD88(2004.65) Field Book 060852

# MONTICELLO Pump Station


TBM: MONT


TBM: MONT

Finished Floor = 2.65 feet NAVD88(2004.65) Field Book 060851

# OP #1 Pump Station

TBM: OP01

TBM: OP01

OP #1 Pump Station

OP #1 Melpomene Pump Station #1

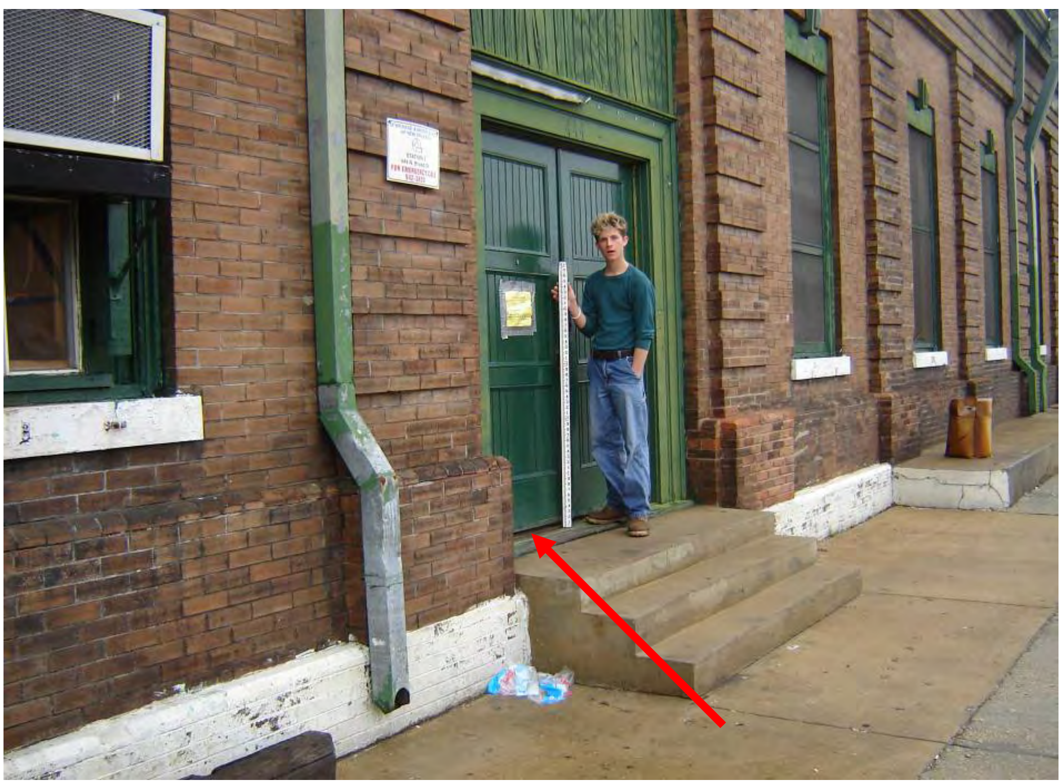

Finished Floor = 1.65 feet NAVD88(2004.65) Field Book 060851

# OP #2 Pump Station

TBM: OP02


TBM: OP02

OP #2 Pump Station



Finished Floor = 2.04 feet NAVD88(2004.65) Field Book 060851

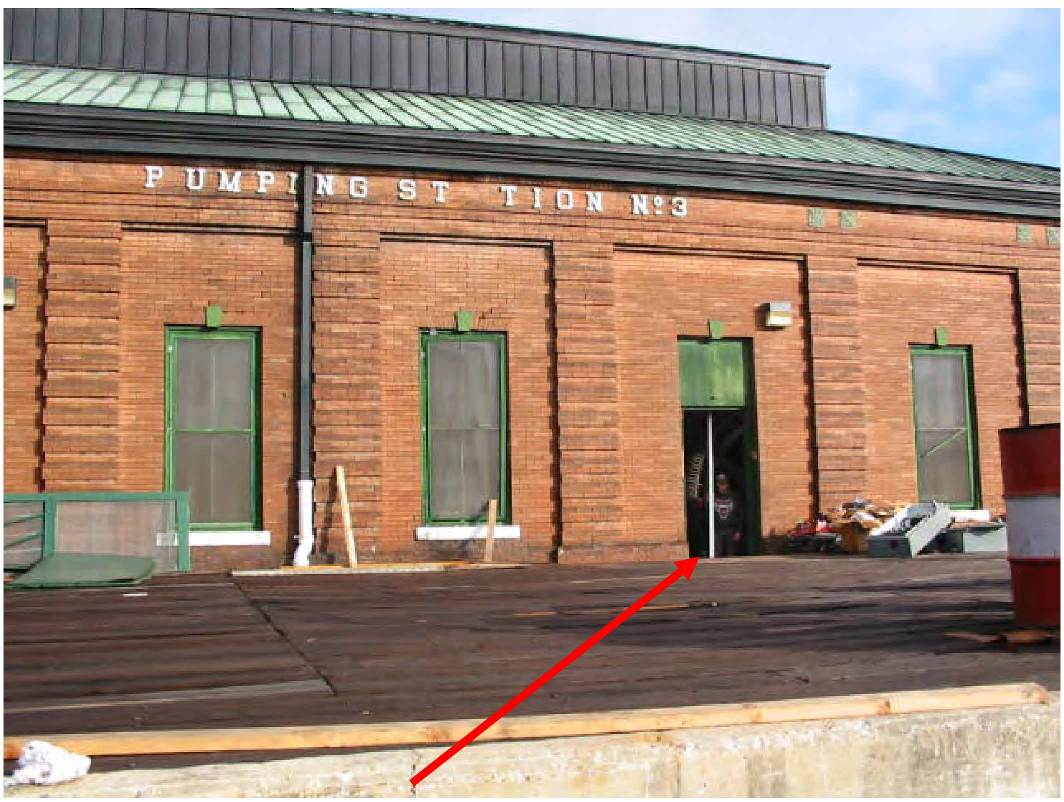
OP #2 PUMP STATION

# OP #3 Pump Station

TBM: BLOU


TBM: BLOU

OP #3 Pump Station




Finished Floor = 1.23 feet NAVD88(2004.65) Field Book 060851

# OP #4 Pump Station

TBM: OP04

TBM: OP04

OP #4 Pump Station

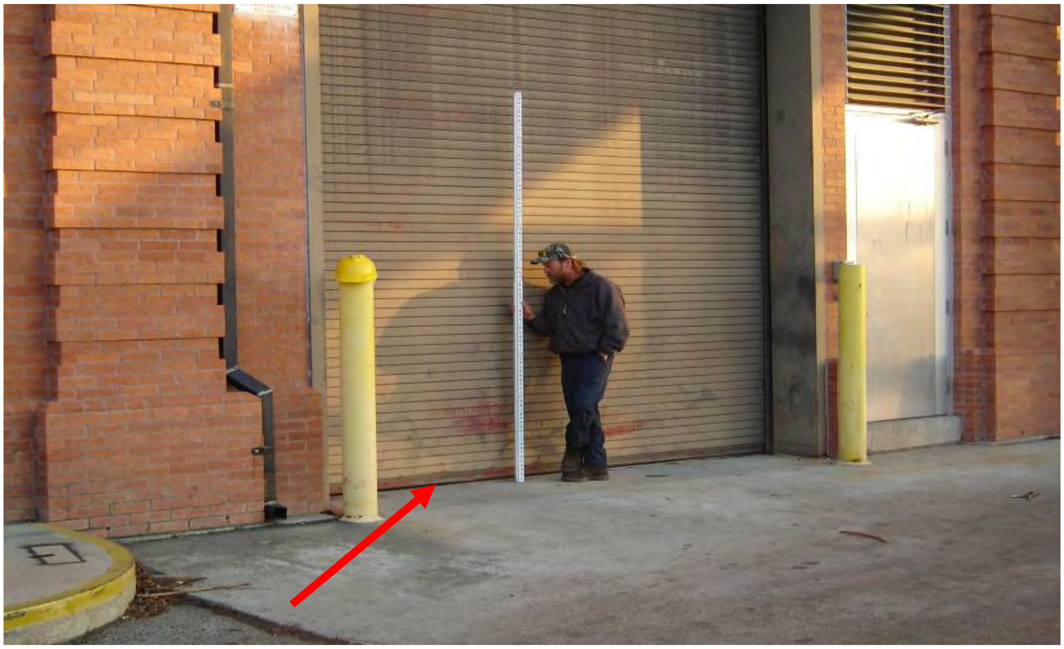
Finished Floor = 2.53 feet NAVD88(2004.65) Field Book 060851

## OP #5 Pump Station

Finished Floor = 1.88 feet NAVD88(2004.65) Field Book 060851

# OP # 6 Pump Station


Finished Floor #1 = 1.90 ft, NAVD88(2004.65) Bk.060852, Pg. 40



Finished Floor #2 = 0.85 ft, NAVD88(2004.65) Bk.060852, Pg. 40

Finished Floor #3 = 4.75 ft, NAVD88(2004.65) Bk.060852, Pg. 40

## OP #7 Pump Station

TBM: OP07

TBM: OP07

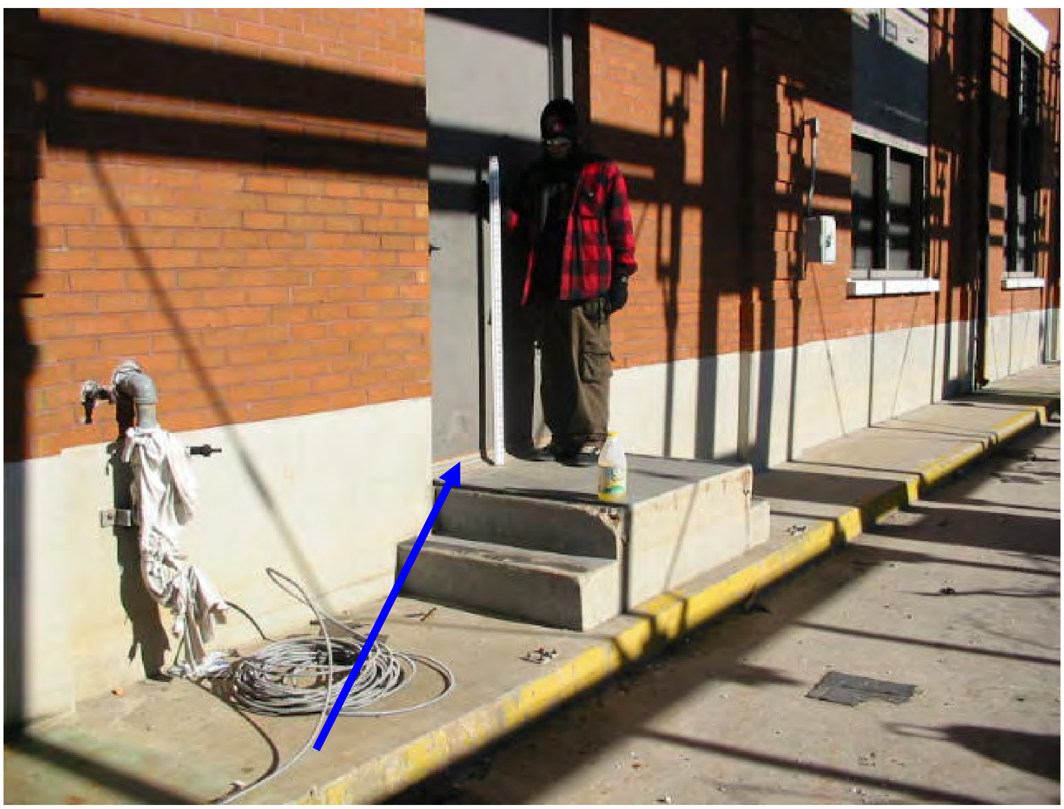

Finished Floor = 2.03 feet NAVD88(2004.65) Field Book 060851

# Citrus Pump Station -- OP 10


TBM: OP10

Citrus Pump Station OP 10

Finished floor = -1.50 feet NAVD 88 2004.65 Field book 060851



Finished floor = -1.50 feet NAVD 88 2004.65 Field book 060851

## OP 11 Pump Station


TBM: OP11


TBM: OP11

OP 11 PUMP STATION

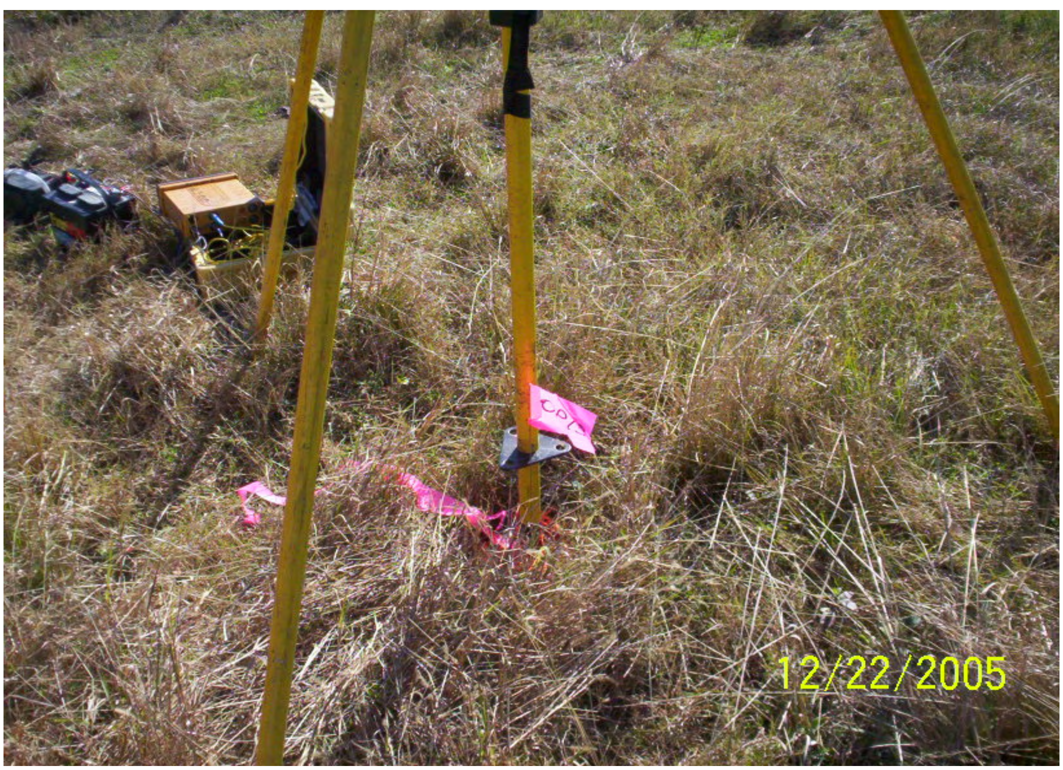
Finished Floor = 2.62 feet NAVD88(2004.65) Field Book 060852

# OP 12 Pump Station

OP 12 Finished Floor = 0.44 feet NAVD88(2004.65) Field Book 060851

# OP 13 Pump Station


TBM: OP13




TBM: OP13

OP #13 PUMP STATION

Finished Floor = 0.64 feet NAVD88(2004.65) Field Book 060852

## Jahncke Pump Station OP 14


TBM: OP14

Jahncke OP 14

Finished Floor = 14.93 feet NAVD88(2004.65) Field book 060851

# OP 15 Pump Station


TBM: OP15


TBM: OP15

OP 15 Pump Station

Finished Floor #1 = -0.18 feet NAVD88(2004.65) Field Book 060851

Finished Floor #2 = 9.16 feet NAVD88(2004.65) Field Book 060851

# St. Charles Pump Station OP 16


TBM: OP16


TBM: OP16

OP #16 -- ST. CHARLES PUMP STATION

Finished Floor = 14.85 feet NAVD88(2004.65) Field Book 060851

# OP 17 Station D Pump Station

TBM: OP17

TBM: OP17

OP 17 Pump Station

Finished Floor = 0.75 feet NAVD88(2004.65) Field book 060851

# OP 18 Maxent Pump Station


TBM: OP18


TBM: OP18

Finished Floor = 1.56 feet NAVD88(2004.65) Field book 060851

# OP 19 Pump Station

OP 19 Finished Floor #1 =3.79 feet NAVD88(2004.65) Field Book 060851

OP 19 Finished Floor #2 = -4.33 feet NAVD88(2004.65) Field Book 060851

# OP 20 Amid Pump Station


TBM: OP20


TBM: OP20

OP 20 Amid Pump Station


Finished Floor (Upper) = 19.20 feet NAVD88(2004.65) Field Book 060851

Finished Floor = 3.69 feet NAVD88(2004.65) Field Book 060851

# PRITCHARD Pump Station

Finished Floor = 3.23 feet NAVD88(2004.65) Field Book 060851

# Appendix 27
# Plaquemines Parish Pump Stations

**BARREIRE Pump Station**

Finished Floor = 6.73 feet NAVD88(2004.65)

## BELAIR Pump Station

Belair Pump Station

Finished Floor = 2.81 feet NAVD88(2004.65)

# BELLE CHASE #1 Pump Station


TBM: BEL1


TBM: BEL1

Finished Floor = 4.80 feet NAVD88(2004.65)

BELLE CHASE #1 Pump Station

# BELLE CHASE #2 Pump Station


TBM: BEL2


TBM: BEL2

Finished Floor = 9.67 feet NAVD88(2004.65)

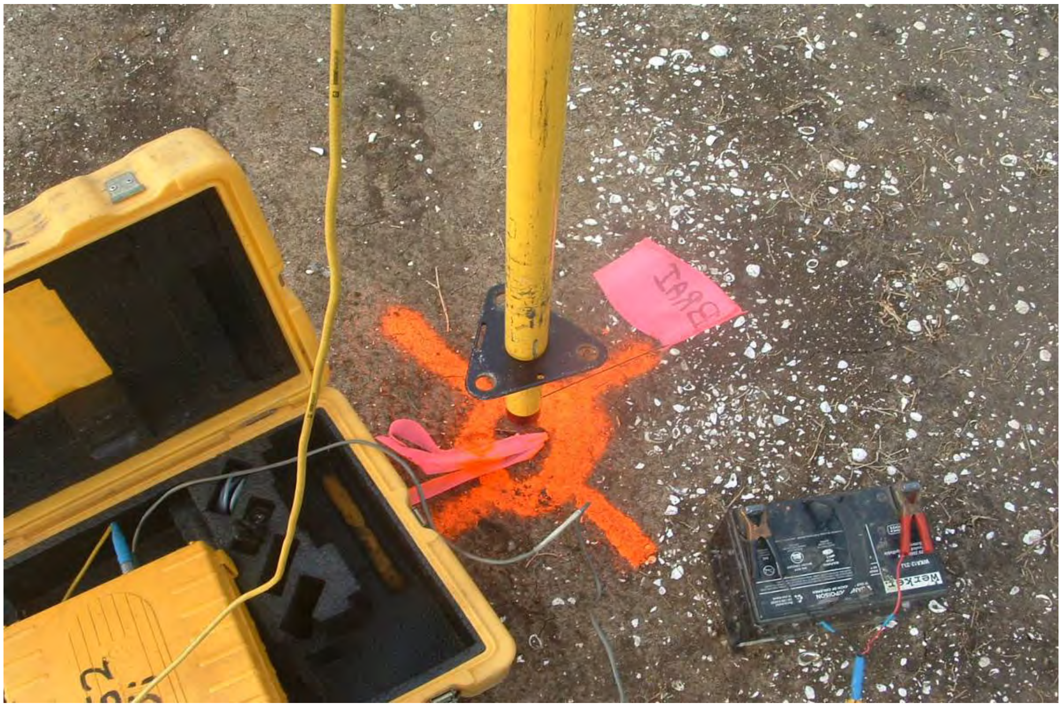
Belle Chase #2 Pump Station

## Bellevue Pump Station

Finished Floor = 12.72 feet NAVD88(2004.65)

# Braithwaith Pump Station

TBM: BRAI




TBM: BRAI

Finished Floor #1 = 7.81 feet NAVD88(2004.65) Field Book 060852

Finished Floor #2 = 8.11 feet NAVD88(2004.65) Field Book 060852

## DIAMOND Pump Station


DIAMOND PUMP STATION


Finished Floor = 10.37 feet NAVD88(2004.65) Field Book 060854

# DUVIC (Venice) Pump Station

DUVIC(VENICE) PUMP STATION

Finished Floor = 16.38 feet NAVD88(2004.65) Field Book 060854

# GAINARD WOODS Pump Station


TBM: GAIN


TBM: GAIN

Finished Floor #1 = 0.36 feet NAVD88(2004.65) Field Book 060854

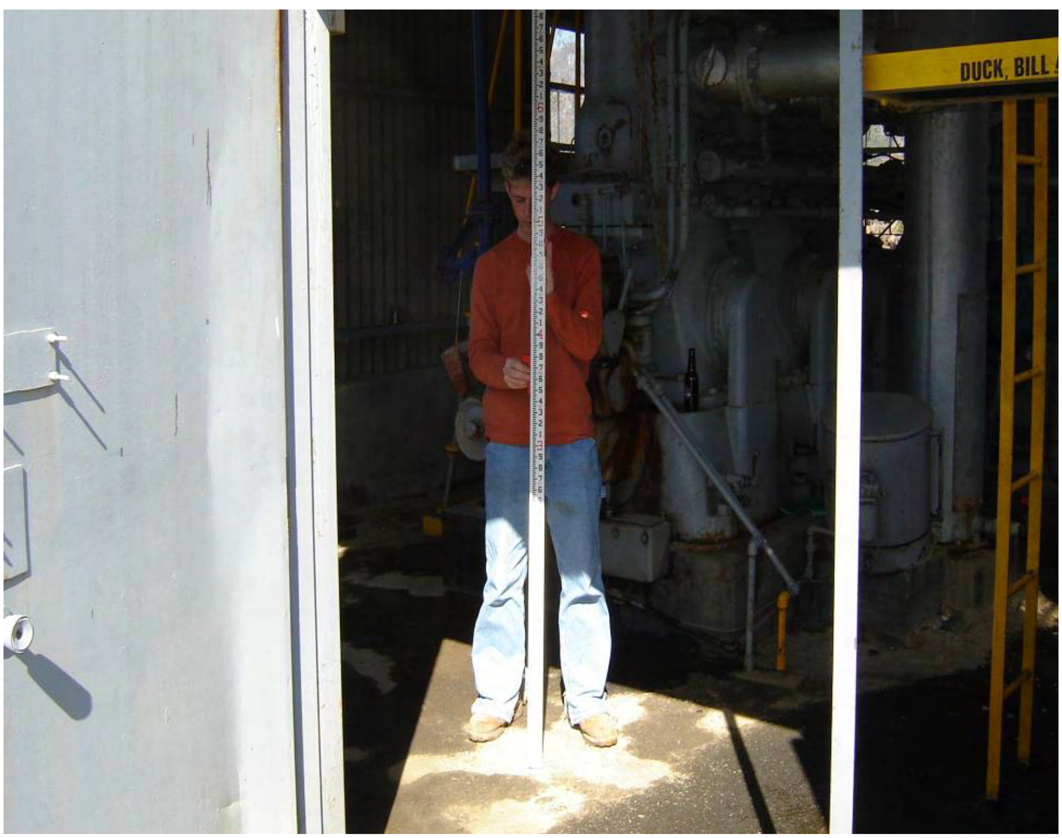
Finished Floor #2 = 4.80 feet NAVD88(2004.65) Field Book 060854

# GRAND LIARD(BURAS) Pump Station

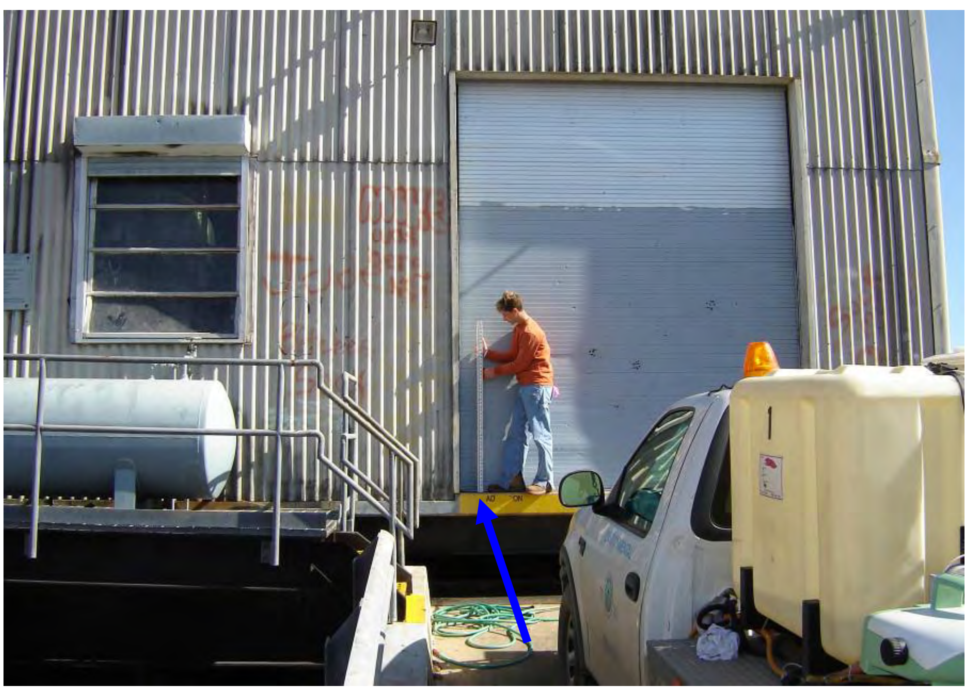

TBM: GRAL


TBM: GRAL

Finished Floor #1 = -3.12 feet NAVD88(2004.65) Field Book 060854



Finished Floor #2 = -8.21 feet NAVD88(2004.65) Field Book 060854



Finished Floor #3 = 9.27 feet NAVD88(2004.65) Field Book 060854

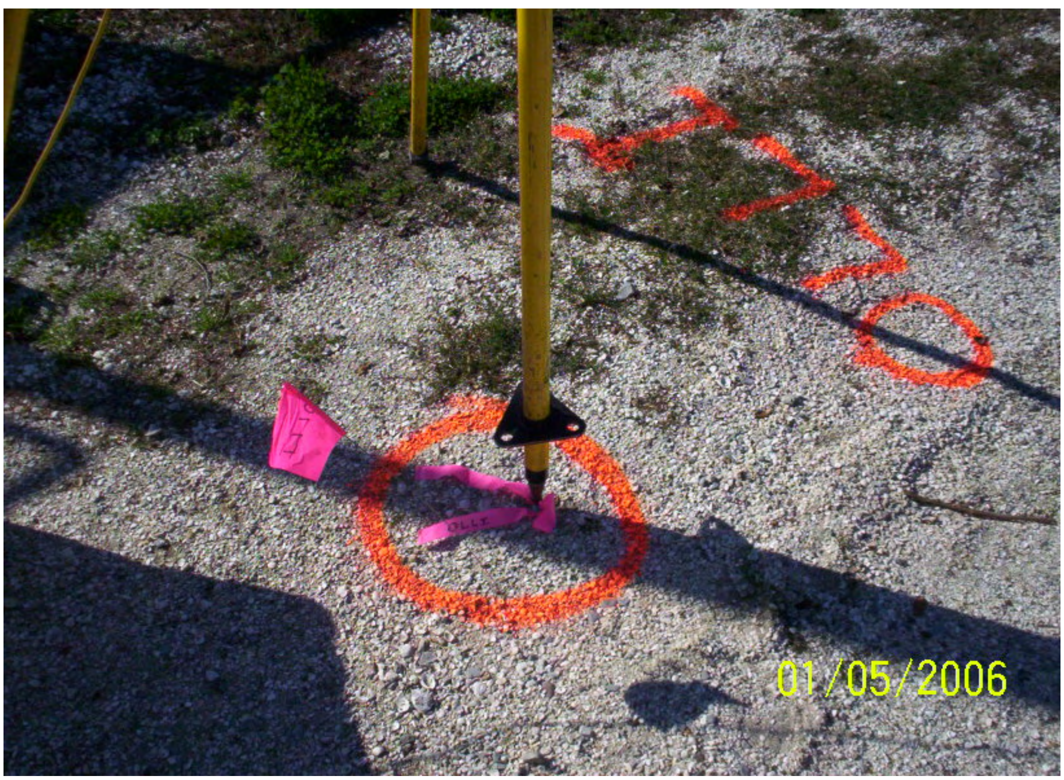
## HAYES Pump Station

HAYES PUMP STATION

Finished Floor = 6.74 feet NAVD88(2004.65) Field Book 060854

## OLLIE #2 Pump Station


TBM: OLLI




TBM: OLLI

OLLIE #2 PUMP STATION

Finished Floor = 9.52 feet NAVD88(2004.65) Field Book 060852

# OLLIE LOWER PUMP STATION

Ollie Lower Pump Station
Finished Floor = 3.44 feet NAVD88(2004.65) Book 060858

## OLLIE UPPER PUMP STATION

Ollie Upper Pump Station
Finished Floor = 3.50 feet NAVD88(2004.65) Book# 060858

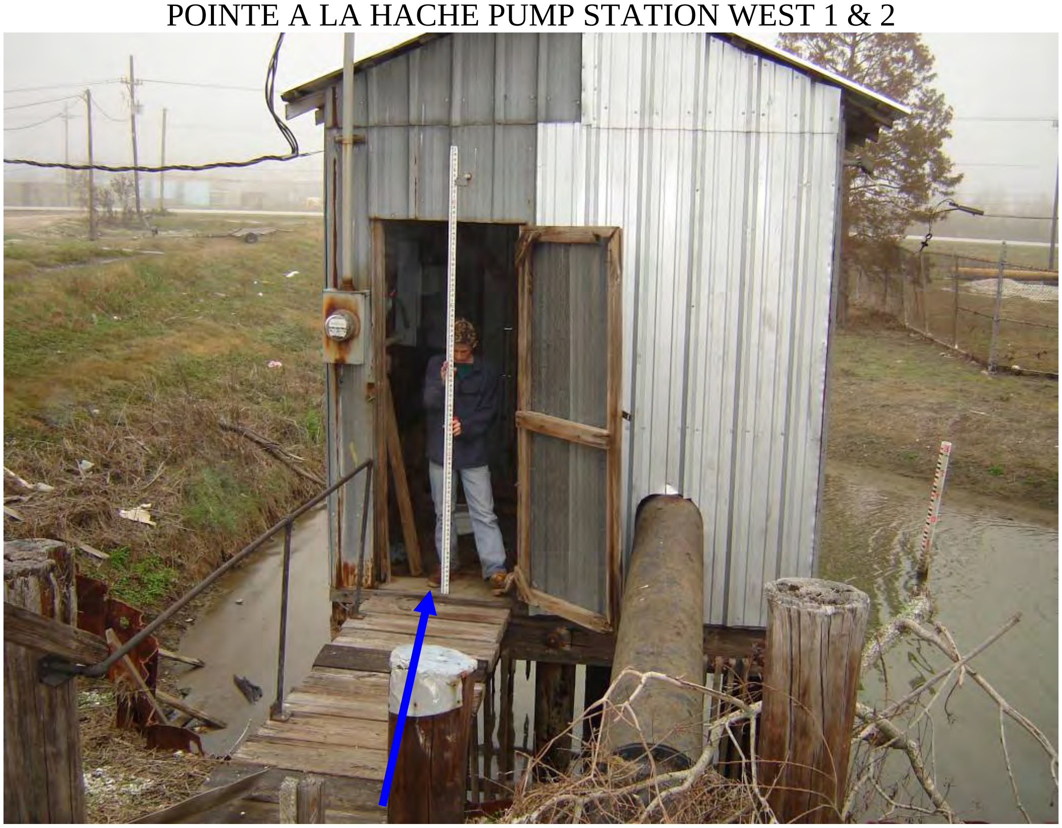
## POINTE A La HACHE EASTBANK Pump Station

POINTE A La HACHE EAST PUMP STATION

Finished Floor = 12.59 feet NAVD88(2004.65) Field Book 060852

## POINTE A La HACHE WEST Pump Station

POINTE A LA HACHE PUMP STATION WEST 1 & 2



Finished Floor #1 = 2.66 feet NAVD88(2004.65) Field Book 060854


Finished Floor #2 = 6.82 feet NAVD88(2004.65) Field Book 060854

## POINTE CELESTE #1 Pump Station

Finished Floor = 12.24 feet NAVD88(2004.65) Field Book 060858

## POINT CELESTE 1 AND 2 Pump stations

# POINTE CELESTE #2 Pump Station

Finished Floor =10.46 feet NAVD88(2004.65) Field Book 060858

**POINT CELESTE 1 AND 2 Pump stations**

# POINTE CELESTE Pump Station

Finished Floor = 4.67 feet NAVD88(2004.65) Field Book 060854

# SCARSDALE Pump Station

TBM: SCAR

TBM: SCAR

SCARSDALE PUMP STATION

Finished Floor = 11.08 feet NAVD88(2004.65) Field Book 060852

## SUNRISE #1 Pump Station

SUNRISE #1 PUMP STATION

Finished Floor Sunrise #1 = 4.71 feet NAVD88(2004.65) Field Book 060854

# SUNRISE #2 Pump Station

SUNRISE #2 PUMP STATION

Finished Floor = 11.59 feet NGVD88(2004.65) Field Book 060854

# WILKINSON PUMP STATION

Finished Floor = 9.76 feet NAVD88(2004.65) Field Book 060858

# Appendix 28
# St. Bernard Parish Pump Stations

**Bayou Ducros #7 Pump Station**

TBM: BYD7

TBM: BYD7

Finished Floor = 1.25 feet NAVD88(2004.65) Field Book 060851

# Bayou Villere Pump Station #3

Bayou Villere Pump Station #3
Finished Floor = 2.16 feet NAVD88(2004.65) Field Book 060851

# E.J. Gore Pump Station #5


E.J. Gore Pump Station

Finished Floor = 4.75 feet NAVD88(2004.65) Field Book 060851

# FORTIFICATION #1 Pump Station

Finished Floor = 1.31 feet NAVD88(2004.65) Field Book 060851

# Guichard Pump Station #2

Guichard Pump Station #2

Finished Floor = 1.91 feet NAVD88(2004.65) Field Book 060851

# Jean Lafitte Pump Station #6

TBM: JEA6

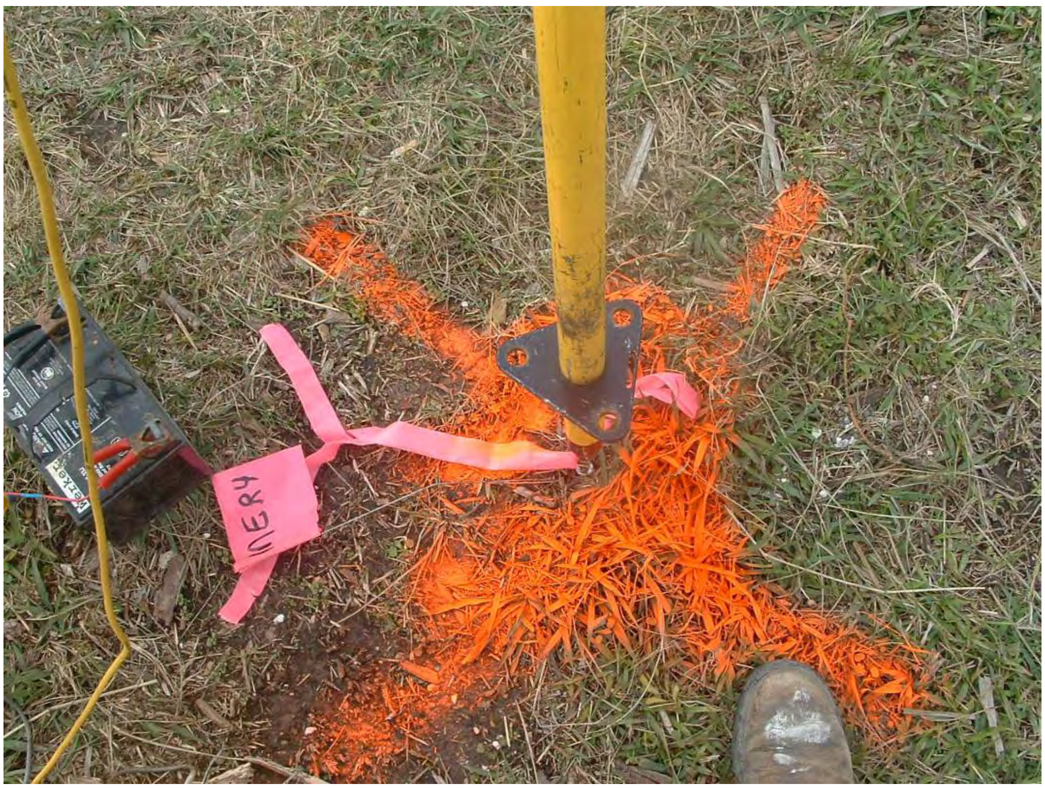

TBM: JEA6

Finished Floor #1 = 15.52 feet NAVD88(2004.65) Field Book 060851


Finished Floor #2 = 2.50 feet  NAVD88(2004.65) Field Book 060851

# MERAUX #4 Pump Station

TBM: MER4




TBM: MER4

Finished Floor #1 = 13.92 feet NAVD88(2004.65) Field Book 060851

Finished Floor #2 = 2.43 feet NAVD88(2004.65) Field Book 060851

# ST. MARY #8 Pump Station

TBM: STMY


TBM: STMY

Finished Floor = 1.24 feet NAVD88(2004.65) Field Book 060851

# Appendix 29
# St. Charles Parish Pump Stations

**DESTREHAN #1 Pump Station**

DESTREHAN #1 Pump Station


Finished Floor #1 = 14.21 feet NAVD88(2004.65) Field Book 060858


Finished Floor #2 = 8.39 feet NAVD88(2004.65) Field Book 060858

## DESTREHAN #2 Pump Station

## DESTREHAN #2 Pump Station

Finished Floor = 5.71 feet NAVD88(2004.65) Field Book 060858

## NEW SARPY Pump Station

## NEW SARPY Pump Station

Finished Floor = 8.92 feet NAVD88(2004.65) Field Book 060858

## SCHEXNAYDRE Pump Station

Finished Floor = 8.36 feet NAVD88(2004.65) Field Book 060858

## TREPAGNIER Pump Station

Finished Floor = 10.50 feet NAVD88(2004.65) Field Book 060858

# Appendix 30
# 1985 New Orleans Policy on NGS Benchmarks

CEMVD-ET-ET (CEMVN-ED/26 Oct 00) 1st End 31 January 2001

MEMORANDUM FOR Commander, New Orleans District, ATTN: CEMVN-ED

SUBJECT: CEMVN-ED Policy Letter of 1985 - NGS Benchmarks

1. We concur with your proposal to use the NAVD88 benchmark information for future work on all projects. Accordingly, the new policy is as follows:

a. All gages will be set to conform to the NAVD88 benchmark information.

b. Main stem features of the MR&T project under construction or to be constructed in the future will utilize the NAVD88 benchmark elevations.

c. Off-main stem projects of the MR&T under construction or to be constructed in the future will use the NAVD88 benchmark data.

d. All O&M dredging will use the NAVD88 benchmark data.

e. Hurricane protection projects under construction or to be constructed in the future will use the NAVD88 benchmark data.

2. We also agree that if CORS proves to be a reliable and accurate system for determining benchmark elevations, MVD and the New Orleans District should re-evaluate the above policy to consider use of the CORS benchmark information in lieu of the NAVD88 benchmark information. Further, the New Orleans District should at that time begin evaluation of completed projects to determine whether or not modifications are necessary to achieve authorized levels of protection.

3. We request that you provide MVD semi-annual status reports on the installation and operation of the CORS. We are interested in confirming its accuracy in determining benchmark information and subsidence rates as well as evaluating its application in other MVD districts.

Michael Fallon

Encls
nc

MICHAEL P. FALLON, P.E.
Chief, Engineering and
Construction Division

CF:
CECW-EE (M. K. Miles)
CEMVD-PM

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT. CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CEMVN-ED 26 October 2000

MEMORANDUM FOR Chief, Engineering Division, Mississippi Valley Division, P. O. Box 80, Vicksburg, MS 39181-0080

SUBJECT: CEMVN-ED Policy Letter of 1985 - NGS Benchmarks

1. Reference subject policy letter, and endorsements thereto, copy attached.

2. The New Orleans District has been abiding by the policy outlined in the referenced letter since its approval by the Division Office. In the 15 years since adopting this policy, the NGS has no longer performed the surveying of our reference benchmarks to publish new epochs and, most assuredly, we have witnessed continued subsidence. Until recently there has been very little alternative for maintaining accurate vertical control.

3. This district has recently hired an expert cartographer and geographer (Mr. Clifford Mugnier) to assist us on this issue. He has presented us with a proposal to implement and operate GPS Continuously Operating Reference Stations (CORS), which will measure gravity and accommodate subsidence, (See Attached, "GPS Leveling In The Gulf Coast Region"). This system will need to be validated with absolute gravity observations. We intend to implement this proposal and to cooperate with state and other federal agencies in South LA in establishing a network of CORS located at sites of mutual benefit. This vertical control network will provide the means for maintaining accurate vertical control.

4. It is becoming increasingly untenable to maintain the existing policy. We are proposing to use the NAVD88 for future work on all projects (Federal Register extract attached). All of our partners are using this datum for their work, and the existing policy is causing great confusion. We propose to abandon the 1985 policy and request your oncurrence. We intend to evaluate the impacts of this on a project-by-project basis, and will take appropriate mitigation actions.

Robert J Fairless, P.E.
for Gerard S. Satterlee, P.E.
Chief, Engineering Division

Encls

CF:
CEMVN-CD
CEMVN-OD
CEMVN-DE

# GPS LEVELING IN THE GULF COAST REGION

The Height Modernization Program of the National Geodetic Survey (NGS) is made possible by the development of "GEOID99," the mathematical model of the equipotential gravity field of the United States. GPS Leveling is a procedure that utilizes this concept, but requires independent validation and observation of benchmark velocities in regions of crustal motion. The ability to independently observe and measure subsidence with changes in Absolute Gravity is a new technology applicable to the Gulf Coast Region. GPS Continuously Operating Reference Stations (CORS) do record the variation in their own three-dimensional coordinates. However only the independent measurement of changes in Absolute Gravity allow the validation of the vertical component of CORS sites in a subsidence-prone region for short-term use. It is thought that 4 to 5 years of CORS site operation in a subsidence area will provide some validation of vertical movement of the CORS site itself, but short-term variations of subsidence rates can be masked by noise. The independent determination of changes in elevation by observing changes in the absolute gravity at the same point provide that physical certainty.

For an area of crustal motion, GPS Leveling must be accomplished by GPS observation of benchmarks for 30 minutes on one day, (say in the morning), and for 30 minutes the following day, in the afternoon. The two observation periods separated by a day insure that the GPS constellation above the observer's local horizon will be substantially different and free of geometric bias in a simultaneous post-processed solution. The maximum distance from a mobile observer using a dual-frequency geodetic survey-grade GPS receiver to a CORS site is 50 statute miles. The accuracy achieved with proper post-processing is **two centimeters vertical**. This represents the state of the art if each CORS site is validated with the observation of Absolute Gravity every year at each CORS site.

The data collected at each CORS site must be edited and adjusted on a daily basis and submitted electronically to the National Geodetic Survey. Acceptance and publication of the observed data from each CORS site by NGS constitutes the establishment of the national infrastructure of geodetic control with today's technology. LSU will provide the daily data processing support, the continuous observation of Absolute Gravity at LSU and on a rotating basis at all CORS sites, and the establishment of fiducial benchmarks. Fiducial benchmarks will be established and periodically re-observed at strategic locations throughout the NOD with GPS Leveling procedures and observation of Absolute Gravity with outdoor portable instruments.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT CORPS OF ENGINEERS
P O BOX 60267
NEW ORLEANS LOUISIANA 70160

REPLY TO
ATTENTION OF
LMNED-S

7 August 1985

SUBJECT: NGS Benchmarks

Commander, Lower Mississippi Valley Division
ATTN: LMVED

1. Reference is made to the following:

a. LMNED letter dated 2 November 1984 to LMVD, subject supra.

b. LMVED letter dated 5 March 1985 to RA John D. Bossler, subject: Adjustments to NGS Benchmarks.

c. John D. Bossler letter to LMVD dated 29 March 1985 in response to reference b above.

d. LMVED-TS letter dated 12 April 1985 to LMNED-S subject: Adjustments to NGS Benchmarks.

e. LMVED letter dated 1 May 1985 to LMNED-S subject: Adjustments to NGS Benchmarks, and 1st End thereto.

2. In essence, it is the position of NGS as set forth in reference c above that the current (1983) benchmark elevations are correct, but that they cannot be used in conjunction with earlier values to derive estimates of subsidence which are necessarily valid even in order of magnitude. Thus we are left with a problem of setting project grades to provide the level of protection authorized. The problem is particularly acute on projects which are partially complete, in that, if we adopt the new benchmark elevations for construction without altering design flowlines, we ensure that those projects will provide inconsistent levels of protection; with the previously constructed portions offering lower levels of protection than those to be constructed in the future. At the same time, it would hardly be prudent, based on what we now know about benchmark elevations, to embark on a program of wholesale raising of previous construction to conform to the latest elevations. This is particularly true in situations in which design flowlines are primarily a function of discharge with tide level having little effect, and in tidal cases where increases in grade can only be achieved through demolition and reconstruction.

3. The problem extends as well to our stream gaging network since the gages which comprise that network are ordinarily adjusted to conform to the latest information published by NGS. As an example, consider the Carrollton gage, which is typical of gages at and below New Orleans. It has been raised about 0.6 foot since 1952 (1983 data have not yet been applied) with the result that the reading of the staff now corresponds to a reading 0.6 foot lower on the 1952 staff. Application of the 1983 data would result in raising the staff another half foot or a total increase of over 1 foot.

4. The problem is exacerbated by the information, recently received, that the 1983 data have been superseded by the results of releveling done in the New Orleans area at the request of local officials. New elevations for benchmarks in Jefferson, St. Bernard, Plaquemines, and Orleans Parishes have been published which, in most instances, represent significant upward revisions of the 1983 data. Additional results of the releveling are being processed and it seems reasonable to expect that they will reflect the same upward trends. The overall significance of these changes in the light of the repeated and ringing affirmations of confidence in the 1983 data which appear in NOAA's letter of 29 March 1985 is not easy to assess, but it does further weaken the case for imputing, with any reasonable confidence, hard physical significance to the changes in benchmark elevations. Yet the data promulgated by NOAA, given their presumed primacy in deciding where the earth's crust is in the vertical plane, cannot be ignored.

5. While the NGS program (cadastre) for evaluating subsidence may well produce data relevant to our problem (and for this reason alone, we would be well advised to support it) that program offers litle of utility in the foreseeable future. Thus we must select a course of action without material assistance from NGS.

6. Despite the absence of firm implications to be drawn from changing benchmark data, we believe that a clearly defined policy should be derived concerning the use of benchmark data in our various activities. Accordingly, we propose the following actions:

a. All gages will be set to conform to the latest available benchmark information published by NGS. Since both the gage information and the NGS data are widely disseminated, to do otherwise would be to court public confusion.

b. Modification of projects which have been completed will not be considered. The level of precision in the current data, and the practical difficulty and cost of changing such projects combine to mandate this course of action at least for the foreseeable future.

c. The main stem features of the MR&T project, such as MRL and Atchafalaya Basin, will be constructed utilizing the latest pre-1983 benchmark elevations. The grade requirements for these features are driven primarily by discharge and since subsidence presumably affects both bed and banks, required levee <u>heights</u> should be little affected by it. Thus, a shift to the new, lower benchmarks would result in the construction of levees higher than required to provide the authorized level of protection. There may be some problem with this approach at the lower (gulfward) ends of the system where tide becomes an increasingly important factor, and we plan to give that continuing consideration.

d. Off-main stem projects of the MR&T which are under construction or will be constructed in the future will use the latest benchmark data published by NGS at the time construction is/was started. The need for revision will be considere as construction proceeds.

e. All O&M dredging will use the latest available benchmark data published by NGS prior to the 1983 data. A change to the new data would mean that the dept of dredging in Southwest Pass, for example, would be lowered by about 1 foot. Given the perennial commotion by navigation interests, and considering the intensity of it this past year, such a course of action would be ill advised to say the least.

f. Hurricane protection projects which are partially complete will use the NGS benchmarks current at the time of construction of the first increment of the project. To shift to the later NGS data without altering the heights of previously constructed portions would make "fuseplugs" of those portions and thus impose a gratuitous servitude on the lands and facilities they protect. And altering previously constructed works would not be practicable.

g. New hurricane protection projects will be constructed using the latest available NGS benchmark data.

h. We plan to respond affirmatively to NOAA's invitation to participate in this "cadastre" program to better evaluate subsidence. Based on NOAA's estimate the total costs would be $2.0 million in the first year, $525 thousand in the second year, and $345 thousand annually thereafter. Our participation would be in the form of membership on technical study groups and providing data. We do not, at this time, anticipate providing any direct funding.

7. Approval of the course of action set forth in paragraph 6 is recommended.

FOR THE COMMANDER:

Encls

FREDERIC M. CHATRY
Chief, Engineering Division

LMVED-TS (LMNED-S/7 Aug 85) 1st End Mr. Johnson/msm/5935
SUBJECT: NGS Benchmarks

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39180-0080

1 9 SEP '85

TO: Commander, New Orleans District, ATTN: LMNED-S

Your course of action outlined in para 6 of the basic letter is approved subject to the following comments:

a. Para 6b. We concur in general with this position; however, you should conscientiously review your flood control works and structures to ensure there are no exceptions that should be individually analyzed with an independent decision made on the specifics of that case.

b. Para 6c. While we agree in general with the rationale presented, the net result would be that there will be further disparity among levee grades, flowlines, and floodway operations. Therefore, the project design flowline of the Mississippi River and Tributaries Project should be adjusted within the affected areas to maintain comparability among the above elements.

c. Para 6f. Consideration should be given to reanalyzing and modifying (if needed) hurricane protection work in high density urban areas where the datum changes will drastically reduce the level of protection.

FOR THE COMMANDER:

William R. Hill for

5 Encls
nc

FRED H. BAYLEY III
Chief, Engineering Division

[Docket No. 930650-3150]

**Affirmation of Vertical Datum for Surveying and Mapping Activities**

**SUBAGENCY:** National Ocean Service, Coast & Geodetic Survey. National Oceanic and Atmospheric Administration, DOC.
**ACTION:** Notice.

**SUMMARY:** This Notice announces a decision by the Federal Geodetic Control Subcommittee (FGCS) to affirm the North American Vertical Datum of 1988 (NAVD 88) as the official civilian vertical datum for surveying and mapping activities in the United States performed or financed by the Federal Government. and to the extent practicable, legally allowable, and feasible, require that all Federal agencies using or producing vertical height information undertake an orderly transition to NAVD 88.

**FOR FURTHER INFORMATION CONTACT.** Mr. James & Stem, N/CG1x4, SSMC3, Station 9357, National Geodetic Survey. NOAA, Silver Spring, Maryland 20910; telephone: 301-713-3230.

**SUPPLEMENTARY INFORMATION** The Coast and Geodetic Survey (C&GS), National Geodetic Survey (NGS), has completed the general adjustment portion of the NAVD 88 project, which includes approximately 80 percent of the previously published bench marks in the NGS data base. The remaining "posted" bench marks which comprise approximately 20 percent of the total will be published by October 1993. Regions of significant crustal motion will be analyzed and published as resources allow.

NAVD 88 supersedes the National Geodetic Vertical Datum of 1929 (NGVD 29) which was the former official height reference (vertical datum) for the United States. NAVD 88 provides a modem, improved vertical datum for the United States, Canada, and Mexico. The NAVD 88 heights are the result of a mathematical least squares general adjustment of the vertical control portion of the National Geodetic Reference System and include 80,000 km of now U.S. Leveling observations undertaken specifically for this project.

NAVD 88 height information in paper or digital form is available from the National Geodetic Information Branch, N/CG174, SSMC3, Station 9202, National Geodetic Survey. NOAA, Silver Spring, Maryland, 20910; telephone: 301-713-3242.

Dated: June 21, 1993.
**W. Stanley Wilson,**
*Assistant Administrator for Ocean Services and Coastal Zone Management. NOAA.*
[FR Doc. 93-14922 Filed 6-23--93: 8:45 am)
**BILLING CODE 351**

# Appendix 31
# GPS Network Adjustment - IPET Project Report

**U.S. DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Admin.**

**COMPUTATION**
**of**
**HORIZONTAL CONTROL**

NAD83 (1991)
NAVD 88

State: Louisiana

LOCALITY: New Orleans and coastal areas
50 miles to the south
and 70 miles to the NE

..............................

Year of Observations, 2006
Year of Computation, 2006

Chief of Party: 3001, Inc

Observer: various

Computer: Brian Shannon (USE) & Jeff Olsen

U.S. DEPARTMENT OF COMMERCE
National Oceanic & Atmospheric Administration
National Ocean Service
National Geodetic Survey

REPORT OF HORIZONTAL CONTROL COMPUTATIONS
Observation and Analysis Division
*************************

State Identification: LA-876

Classification: B-order (1:1,000,000)

Horizontal Datum: NAD 83 (1992) Vertical Datum: NAVD 88 (2004.65)

Geoid: GEOID03 Ellipsoid: GRS 80

Locality: New Orleans and coastal areas 50 miles S and 70 miles NE

Acc. No.: GPS 2212

Date of Field Work: 2006 Chief of Party: 3001, Inc.

******* OFFICE COMPUTATION *******

Accession No.: GPS° 2212 Date of Computation: 2006

Number of Stations: 24 including 4 CORS

| | | | | |
|---|---|---|---|---|
| New horizontal pos. | = 4 | Ellip ht readjusted | = 1 |
| Old horizontal pos: | | | |
| Fixed: | = 15 | | |
| Readjusted: | = 5 | | |
| Total | = 24 | | |

Free adjustment variance of unit weight ($\sigma_o^2$): = 88.60
Constrained adjustment variance of unit weight ($\sigma_1^2$): = 186.50
Ratio: ($\sigma_1^2$ / $\sigma_o^2$): = 2.105

Jeff Olsen
Geodesist

Maralyn L. Vorhauer
Branch Chief

Juliana Blackwell
Division Chief

**PROJECT DATA**

Locality: New Orleans and coastal areas 50 miles S and 70 miles NE

Source: GPS 2212

Year of Observation: 2006
Number of occupied stations: 20
Number of unoccupied stations: 4 (COVG, ENG2, GRIS and NDBC CORS)

Variance of Unit Weight, free adjustments (horizontal and vertical): 88.60
Degrees of Freedom: 213

Variance of Unit Weight, constrained horizontal adjustment: 186.50
Degrees of Freedom: 255

Variance of Unit Weight, constrained vertical adjustment: 91.86
Degrees of Freedom: 226

**INTERAGENCY PERFORMANCE EVALUATION TASKFORCE (IPET) TASK 6 PHASE 1 STATIC GPS SURVEY**

**PURPOSE**

Phase 1 was a geodetic survey designed to connect historical tide stations to the National Spatial Reference Network (NSRS). The focus of the project was the determination of the current separation of NAVD 88 from Local Mean Sea Level (LMSL) using tide stations that populated the region in the early 1980's. This approach was intended to enable answers more quickly than would be possible using the alternative approach--tide gauges installed and operated for a year to measure the separation.

Twenty-five years ago the State of Louisiana worked with NOAA on the Louisiana Marine Boundary Program. NOAA installed dozens of tide stations for durations averaging one year to find the Louisiana low water boundary. Following the devastation of Hurricane Katrina, it was hoped that the historical tidal benchmark data could be combined with current GPS observations to provide an accurate measure of the separation despite thirty years of settlement in the region.

Underlying assumptions for this survey were that LMSL was reasonably constant over the region and that benchmark settlement was not too uneven. If these assumptions were not borne out because of excessive variation in either LMSL or individual benchmarks), the survey could at least be used to monitor settlement compared to a GPS survey done two years prior for the purpose of geodetic vertical control.

**TIME FRAME**

Mr. Mark Huber of the U.S. Army Corps of Engineers, New Orleans District called Mr. Brian Shannon of the Engineer Research and Development Center in early October 2005 to locate tide gauge installations in the New Orleans vicinity. Mr. Shannon proposed using GPS to tie the historical tide stations at this time in lieu of setting gauges. This approach was implemented under Task 6 of the IPET study that had begun following Hurricane Katrina to develop vertical network improvements needed in New Orleans. A coordination meeting with NOAA was held in Alexandria, Virginia on 14 November 2005.

U.S. Army Corps of Engineer personnel performed preliminary reconnaissance on 9 November 2005, confirming three tide stations destroyed: 876 1426 Green Ditch, 876 1529 Martello Castle, and 876 1305 Shell Beach.

Contractors began reconnaissance for Phase 1 on 20 December 2006. GPS observations were performed Jan. 8-9 and 24-25, Feb. 20-21 and March 6-7, 2006. Leveling was performed at various tide stations during January and February, 2006.

## GEOGRAPHIC EXTENT

The project extended west and south from a tide station five miles west of Gulfport, Mississippi to Barataria Bay south of New Orleans on the Gulf of Mexico. It included monuments west of New Orleans along Lake Pontchartrain, east to Lake Borgne and south to Port Sulphur on the Mississippi River. In all, nine tide stations were connected to the NSRS by this project. They are listed next along with the specific mark occupied at each and any marks that were leveled to.

876 1678 MICHOUD SUBSTATION, ICWW

GPS CONTROL MARK

| PID | Designation |
|---|---|
| BH3007 | WES 19 1978 |
| **Marks leveled to at tide station** | |
| BH3007 | WES 19 1978 |
| BH1083 | D 276 1969 |
| no PID | 1678 A 1982 |
| no PID | WES 17 1978 |

876 1402 U.S. HIGHWAY 90, THE RIGOLETS

GPS CONTROL MARK

| | |
|---|---|
| BH1160 | PIKE RM 3 |
| **Marks leveled to at tide station** | |
| BH1164 | PIKE RESET |
| BH1163 | C 193 |

876 1602 LAKE JUDGE PEREZ, HERMITAGE BAYOU

GPS CONTROL MARK

| | |
|---|---|
| AT1392 | 876 1602 C TIDAL |
| **Marks leveled to at tide station** | |
| AT1392 | 876 1602 C TIDAL |
| no PID | 876 1602 A TIDAL |
| no PID | 876 1602 B TIDAL |
| no PID | 876 1602 E TIDAL |
| no PID | 876 1602 F TIDAL |

876 1487 CHEF MENTEUR, CHEF MENTEUR PASS

GPS CONTROL MARK

| | |
|---|---|
| BH1133 | E 3145 |
| **Marks leveled to at tide station** | |
| BH1133 | E 3145 |
| None | 1487 A 1982 |
| None | 1487 B 1982 |

876 1799 M.V. PETRO. DOCK, BAYOU ST. DENIS

GPS CONTROL MARK

| | |
|---|---|
| None | 1799 B 1985 |
| **Marks leveled to at tide station** | |
| no PID | 1799 B 1985 |
| no PID | 1799 A 1985 |
| no PID | 1799 C 1985 |
| no PID | 1799 D 1985 |

876 1494 USACE WEST PT A-LA-HACHE, MISS RIVER

GPS CONTROL MARK

| | |
|---|---|
| no PID | 1494 C 1996 |
| **Marks leveled to at tide station** | |
| no PID | 1494 C 1996 |
| no PID | 1494 A 1996 |
| no PID | 1494 B 1996 |

876 1955 USACE NEW CARROLLTON, MISS RIVER

GPS CONTROL MARK

AU2196 DISTRICT 1A

No leveling

876 1927 USCG NEW CANAL, LAKE PONTCHARTRAIN

GPS CONTROL MARK

BJ1342 ALCO

No leveling

876 1927 USCG NEW CANAL, LAKE PONTCHARTRAIN

GPS CONTROL MARK

BH0937 874 7437 TIDAL 1

No leveling

TIDE STATIONS CONFIRMED DESTROYED, 9 NOVEMBER 2005

876 1426 GREENS DITCH
876 1529 MARTELLO CASTLE
876 1305 SHELL BEACH

## PROCEDURES

GPS observations were performed in four-hour session pairs. Each session used four NAVD 88_2004.65 bench marks and one mark at a tide station. CORS data were included in the processing.

Leveling was performed to second-order class I FGCS standards at each historical tide station.

Processing and adjustment were performed using PAGES and ADJUST.

## CORS

The following four CORS were included in the GPS processing and adjustment: COVG Covington, ENG2 English Turn, GRIS Grand Isle, and NDBC Stennis.

## EQUIPMENT

Trimble SSi and SSE receivers were used during the survey. All antennas were type Compact L1/L2 with ground plane. All tripods were fixed height 2-meter tripods.

## COORDINATION

NOAA and USACE coordinated all planning and specifications. Contract actions were performed through the U.S. Army Engineer District, St. Louis.

## OBSERVATION FILE ANALYSIS

The program CHKOBS was run to verify the Blue Book observation bile (Bfile). All errors identified by CHKOBS except those relating to 0.000 antenna heights were corrected. COMPGB and OBSCHK were run to check the Gfile against the Bfile. All errors identified by these programs were corrected.

## DESCRIPTION FILE ANALYSIS

All stations in this project have either a new description or a recovery note except the CORS, which were omitted from the Dfile. CHKDDESC, DISCREP and NEIGHBOR were run to verify the Dfile formats and to compare the recovery notes with the IDB descriptions. The messages generated by DISCREP reflect differences between the IDB and the submitted data. The new Dfile information will be used to update the IDB.

OBSDES was run to compare the Dfile with the Bfile. The output messages concern the omission of CORS descriptions from the Dfile.

## FREE HORIZONTAL ADJUSTMENT

A minimally constrained horizontal adjustment was run, holding the published NAD83 coordinates and ellipsoid height for Covington CORS ARP. The highest residuals--approximately ten of them in the 2-3 cm range--were investigated. Reprocessing did not yield any meaningful improvement. Only two vectors with high residuals could be rejected without causing a no-check situation. The remaining residuals exceeding 1 cm horizontally and 2 cm vertically had to be carried forward and are tabulated below.

Free adjustment horizontal residuals > 1 cm:

| v | From SSN | 4-char ID | To SSN | 4-char ID |
|---|---|---|---|---|
| 0.0159 | 7 | ALCO | 11 | C189 |
| 0.0157 | 15 | ENG2 | 23 | V375 |
| 0.0147 | 15 | ENG2 | 21 | PIKE |
| 0.0134 | 11 | C189 | 20 | NDBC |
| 0.0132 | 5 | A152 | 2 | 160C |
| 0.0129 | 18 | GRIS | 16 | G358 |
| 0.0128 | 5 | A152 | 2 | 160C |
| 0.0121 | 15 | ENG2 | 23 | V375 |
| 0.0106 | 15 | ENG2 | 21 | PIKE |

Free adjustment vertical (EH) residuals > 2 cm:

| v | From SSN | 4-char ID | To SSN | 4-char ID |
|---|---|---|---|---|
| -0.028 | 23 | V375 | 24 | WE19 |
| 0.027 | 19 | MILN | 15 | ENG2 |
| 0.026 | 14 | E314 | 21 | PIKE |
| 0.025 | 18 | GRIS | 16 | G358 |
| 0.024 | 16 | G358 | 10 | BTID |
| -0.024 | 2 | 160C | 19 | MILN |
| 0.023 | 15 | ENG2 | 17 | G365 |
| 0.022 | 9 | BRO2 | 4 | 7437 |
| 0.021 | 11 | C189 | 20 | NDBC |
| -0.021 | 16 | G358 | 10 | BTID |

## CONSTRAINED HORIZONTAL ADJUSTMENT

All B-order marks and the CORS were initially constrained in position and ellipsoid heights. Residuals in the 4-5 cm range for the position of 876 1899 B Tidal resulted. Residuals in the 5-6 cm range for the ellipsoid height of that mark and for G 365 and 874 7437 Tidal 1 resulted.

The above three marks were freed up in a test adjustment as follows:

876 1899 B Tidal: position and EH
874 7437 Tidal 1: EH
G 365: EH

The following shifts then occurred: for 876 1899 B TIDAL in position: 0.059 m.
In ellipsoid height (EH):

874 7437 TIDAL 1: -0.043 (shifted to -25.963 m from -25.920)
876 1899 B TIDAL: -0.032 (shifted to -25.200 m from -25.168)
G 365: -0.019 (shifted to -25.736 m from -25.717)

The 2- and 3-cm EH shifts for 1899 B and G 365 were considered small enough not to warrant re-adjusting the EH. The published values were restored for those marks.

Positions and/or EH for the following marks were then constrained for the horizontal adjustment:

| STATION NAME | SOURCE of position |
|---|---|
| 874 7437 TIDAL 1 | GPS1606 |
| A 152 | GPS2100 |
| A 193 | GPS2100 |
| ALCO | GPS2100 |
| C 189 | GPS2100 |
| COVINGTON CORS ARP | CORS1460 |
| DISTRICT 1 A | GPS2021 |
| ENGLISH TURN 2 CORS ARP | CORS1674 |
| G 358 | GPS2100 |
| G 365 | GPS2100 |
| GRAND ISLE CORS ARP | CORS1685 |
| MILAN 2 | GPS2100 |
| REGGIO 2 | GPS2100 |
| STENNIS CORS ARP | CORS0680 |
| V 375 | GPS2100 |

| STATION NAME | SOURCE of ellipsoid height |
|---|---|
| A 152 | GPS2100 |
| A 193 | GPS2100 |
| ALCO | GPS2100 |
| 876 1899 B TIDAL | GPS2100 |
| C 189 | GPS2100 |
| COVINGTON CORS ARP | CORS1460 |
| DISTRICT 1 A | GPS2021 |
| ENGLISH TURN 2 CORS ARP | CORS1674 |
| G 358 | GPS2100 |
| G 365 | GPS2100 |
| GRAND ISLE CORS ARP | GPS2100 |
| MILAN 2 | GPS2100 |
| REGGIO 2 | GPS2100 |
| STENNIS CORS ARP | CORS0680 |
| V 375 | GPS2100 |

Highest horizontal residuals:

| v | From SSN | 4-char ID | To SSN | 4-char ID |
|---|---|---|---|---|
| 0.0239 | 15 | ENGLISH TURN 2 CORS | 23 | V 375 |
| 0.0225 | 9 | BROWN 2 | 4 | 874 7437 TIDAL 1 |
| 0.0173 | 19 | MILAN 2 | 15 | ENGLISH TURN 2 CORS A |
| 0.0170 | 4 | 874 7437 TIDAL 1 | 8 | B 31 USE |
| 0.0166 | 7 | ALCO | 11 | C 189 |
| 0.0155 | 4 | 874 7437 TIDAL 1 | 8 | B 31 USE |
| 0.0150 | 15 | ENGLISH TURN 2 CORS | 17 | G 365 |
| 0.0148 | 5 | A 152 | 2 | 876 1602 C TIDAL |
| 0.0140 | 9 | BROWN 2 | 4 | 874 7437 TIDAL 1 |
| 0.0124 | 15 | ENGLISH TURN 2 CORS | 23 | V 375 |
| 0.0122 | 16 | G 358 | 10 | 876 1899 B TIDAL |
| 0.0119 | 22 | REGGIO 2 | 11 | C 189 |

Highest vertical (EH) residuals:

| v | From SSN | 4-char ID | To SSN | 4-char ID |
|---|---|---|---|---|
| 0.0632 | 16 | G 358 | 10 | 876 1899 B TIDAL |
| 0.0569 | 15 | ENGLISH TURN 2 CORS | 17 | G 365 |
| 0.0537 | 11 | C 189 | 20 | STENNIS CORS ARP |
| 0.0508 | 5 | A 152 | 10 | 876 1899 B TIDAL |
| 0.0485 | 11 | C 189 | 20 | STENNIS CORS ARP |
| -0.0484 | 10 | 876 1899 B TIDAL | 22 | REGGIO 2 |
| -0.0416 | 10 | 876 1899 B TIDAL | 3 | 876 1799 B TIDAL |
| -0.0415 | 10 | 876 1899 B TIDAL | 22 | REGGIO 2 |
| 0.0415 | 5 | A 152 | 10 | 876 1899 B TIDAL |
| 0.0397 | 6 | A 193 | 9 | BROWN 2 |
| 0.0373 | 5 | A 152 | 2 | 876 1602 C TIDAL |
| 0.0368 | 22 | REGGIO 2 | 15 | ENGLISH TURN 2 CORS A |
| 0.0359 | 8 | B 31 USE | 20 | STENNIS CORS ARP |
| -0.0357 | 18 | GRAND ISLE CORS ARP | 22 | REGGIO 2 |
| 0.0355 | 6 | A 193 | 9 | BROWN 2 |
| -0.0341 | 21 | PIKE RM 3 | 6 | A 193 |
| 0.0340 | 14 | E 3145 | 21 | PIKE RM 3 |
| -0.0339 | 3 | 876 1799 B TIDAL | 5 | A 152 |
| -0.0338 | 3 | 876 1799 B TIDAL | 5 | A 152 |
| 0.0303 | 15 | ENGLISH TURN 2 CORS | 17 | G 365 |

**FREE VERTICAL ADJUSTMENT**

GEOID03 was used to compute geoid heights for the *86* records. A free vertical adjustment holding the coordinates of COVG and the 2004.65 epoch NAVD 88 orthometric height of Alco was executed. The differences between the free adjustment OH and the data base heights follow:

Free adjustment orthometric heights minus IDB values (m):

| | |
|---|---|
| A 152 | 0.029 |
| A 193 | 0.067 |
| ALCO | 0.000 |
| 876 1899 B TIDAL | -0.016 |
| C 189 | 0.006 |
| COVINGTON CORS ARP | 0.021 |
| DISTRICT 1 A | 0.001 |
| ENGLISH TURN 2 CORS ARP | 0.006 |
| G 358 | 0.020 |
| G 365 | -0.020 |
| GRAND ISLE CORS ARP | 0.000 |
| MILAN 2 | 0.013 |
| STENNIS CORS ARP | 0.004 |
| REGGIO 2 | 0.021 |
| V 375 | -0.005 |

Of these differences, only A 193 stands out at 7 cm. That mark was freed up and a constrained vertical adjustment was run.

## CONSTRAINED VERTICAL ADJUSTMENT

Orthometric heights determined for the 2004.65 epoch of NAVD 88 were derived from two sources, either GPS 2021/C or GPS 2100, and constrained for the following marks in a preliminary adjustment:

A 152
ALCO
876 1899 B TIDAL
C 189
COVINGTON CORS ARP
DISTRICT 1 A
ENGLISH TURN 2 CORS ARP

G 358

G 365
GRAND ISLE CORS ARP
MILAN 2
STENNIS CORS ARP
REGGIO 2
V 375

The following 15 highest vertical residuals resulted:

| v | From SSN | 4-char ID | To SSN | 4-char ID |
|---|---|---|---|---|
| 0.0602 | 16 | G 358 | 10 | 876 1899 B TIDAL |
| 0.0492 | 15 | ENGLISH TURN 2 CORS | 17 | G 365 |
| 0.0449 | 5 | A 152 | 10 | 876 1899 B TIDAL |
| -0.0400 | 10 | 876 1899 B TIDAL | 3 | 179B |
| -0.0396 | 18 | GRAND ISLE CORS ARP | 22 | REGGIO 2 |
| -0.0380 | 18 | GRAND ISLE CORS ARP | 16 | G 358 |
| -0.0367 | 23 | V 375 | 24 | WES 19 |
| -0.0355 | 10 | 876 1899 B TIDAL | 22 | REGGIO 2 |
| 0.0355 | 5 | A 152 | 10 | 876 1899 B TIDAL |
| 0.0349 | 19 | MILAN 2 | 15 | ENGLISH TURN 2 CORS A |
| 0.0347 | 22 | REGGIO 2 | 15 | ENGLISH TURN 2 CORS A |
| -0.0337 | 18 | GRAND ISLE CORS ARP | 19 | MILAN 2 |
| 0.0337 | 5 | A 152 | 2 | 876 1602 C TIDAL |
| 0.0297 | 12 | COVINGTON CORS ARP | 20 | STENNIS CORS ARP |
| -0.0296 | 3 | 179B | 5 | A 152 |

On the basis of the above residuals, 3 additional marks were freed up in a test: 876 1899 B, ENG2 CORS ARP and G 365. These did not shift enough to merit re-adjustment, however (3, 0 and 2 cm respectively) and were returned as constraints. 876 1899 B orthometric ht shifted to -0.022 m from 0.009; G 365 shifted to 0.219 m from 0.243.

## FINAL FREE ADJUSTMENT WITH ACCURACIES

QQ records were generated and a final free adjustment with accuracies was run. Standard deviations were scaled by the a-posteriori standard deviation ('Y' was put in MM record column 4). The length-relative accuracies are listed below, followed by the ellipsoid height accuracies.

LENGTH RELATIVE ACCURACIES (USING A-POSTERIORI WEIGHTS)

| SSN | FROM STATION | SSN | TO STATION | DISTANCE METERS | INTERNAL ACCURACY | EXTERNAL ACCURACY | SURVY ORDER |
|---|---|---|---|---|---|---|---|
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0023) | V 375 | 5083 | 1: 3100000 | 1: 607233 | B |
| ( 0004) | 874 7437 TIDAL 1 | ( 0008) | B 31 USE | 15227 | 1: 4700000 | 1: 932068 | B |
| ( 0004) | 874 7437 TIDAL 1 | ( 0009) | BROWN 2 | 16435 | 1: 4700000 | 1: 949190 | B |
| ( 0011) | C 189 | ( 0014) | E 3145 | 3597 | 1: 1400000 | 1: 1095758 | B |
| ( 0007) | ALCO | ( 0013) | DISTRICT 1 A | 10761 | 1: 3800000 | 1: 2347718 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0022) | REGGIO 2 | 18097 | 1: 12000000 | 1: 2380878 | B |
| ( 0007) | ALCO | ( 0024) | WES 19 | 16927 | 1: 5200000 | 1: 2947633 | B |
| ( 0011) | C 189 | ( 0023) | V 375 | 21462 | 1: 13000000 | 1: 3053890 | B |
| ( 0002) | 876 1602 C TIDAL | ( 0005) | A 152 | 7440 | 1: 3100000 | 1: 3804084 | B |
| ( 0023) | V 375 | ( 0024) | WES 19 | 10464 | 1: 3600000 | 1: 3871739 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0017) | G 365 | 26390 | 1: 11000000 | 1: 3891018 | B |
| ( 0013) | DISTRICT 1 A | ( 0023) | V 375 | 15753 | 1: 6100000 | 1: 4089165 | B |
| ( 0007) | ALCO | ( 0017) | G 365 | 16064 | 1: 5900000 | 1: 4127162 | B |
| ( 0011) | C 189 | ( 0022) | REGGIO 2 | 26558 | 1: 13000000 | 1: 4310612 | B |
| ( 0006) | A 193 | ( 0021) | PIKE RM 3 | 13902 | 1: 4500000 | 1: 4504237 | B |
| ( 0001) | 876 1494 C TIDAL | ( 0019) | MILAN 2 | 16500 | 1: 5800000 | 1: 5368457 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0019) | MILAN 2 | 52062 | 1: 23000000 | 1: 5681789 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0021) | PIKE RM 3 | 37464 | 1: 18000000 | 1: 5775357 | B |
| ( 0011) | C 189 | ( 0020) | STENNIS CORS ARP | 38396 | 1: 24000000 | 1: 6970995 | B |
| ( 0002) | 876 1602 C TIDAL | ( 0019) | MILAN 2 | 22134 | 1: 9300000 | 1: 7483942 | B |
| ( 0014) | E 3145 | ( 0021) | PIKE RM 3 | 12589 | 1: 4300000 | 1: 7591371 | B |
| ( 0005) | A 152 | ( 0010) | 876 1899 B TIDAL | 20531 | 1: 8900000 | 1: 7752871 | B |
| ( 0003) | 876 1799 B TIDAL | ( 0005) | A 152 | 18543 | 1: 5600000 | 1: 8036986 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0020) | STENNIS CORS ARP | 61803 | 1: 46000000 | 1: 8333330 | B |
| ( 0015) | ENGLISH TURN 2 CORS ARP | ( 0018) | GRAND ISLE CORS ARP | 68036 | 1: 38000000 | 1: 9291433 | B |
| ( 0016) | G 358 | ( 0018) | GRAND ISLE CORS ARP | 40402 | 1: 12000000 | 1: 9480518 | B |
| ( 0018) | GRAND ISLE CORS ARP | ( 0019) | MILAN 2 | 34950 | 1: 16000000 | 1: 10264104 | B |
| ( 0010) | 876 1899 B TIDAL | ( 0016) | G 358 | 29945 | 1: 8400000 | 1: 11106667 | B |
| ( 0010) | 876 1899 B TIDAL | ( 0022) | REGGIO 2 | 39175 | 1: 18000000 | 1: 11115581 | B |
| ( 0020) | STENNIS CORS ARP | ( 0021) | PIKE RM 3 | 24344 | 1: 12000000 | 1: 11139841 | B |
| ( 0006) | A 193 | ( 0009) | BROWN 2 | 13771 | 1: 4000000 | 1: 13152962 | B |
| ( 0007) | ALCO | ( 0011) | C 189 | 26765 | 1: 14000000 | 1: 14983210 | B |
| ( 0008) | B 31 USE | ( 0020) | STENNIS CORS ARP | 42394 | 1: 14000000 | 1: 16495678 | B |
| ( 0012) | COVINGTON CORS ARP | ( 0020) | STENNIS CORS ARP | 48474 | 1: 44000000 | 1: 20643070 | B |
| ( 0022) | REGGIO 2 | ( 0023) | V 375 | 22058 | 1: 12000000 | 1: 23005800 | B |
| ( 0003) | 876 1799 B TIDAL | ( 0010) | 876 1899 B TIDAL | 20609 | 1: 6400000 | 1: 24698287 | B |
| ( 0018) | GRAND ISLE CORS ARP | ( 0022) | REGGIO 2 | 67006 | 1: 33000000 | 1: 52527084 | B |
| ( 0001) | 876 1494 C TIDAL | ( 0002) | 876 1602 C TIDAL | 7980 | 1: 3000000 | 1: 66373755 | B |

Distribution of Ellipsoid Height Accuracies

| OC | Number of Accuracies |
|---|---|
| 11 | 0 |
| 12 | 0 |
| 21 | 0 |
| 22 | 0 |
| 31 | 1 |
| 32 | 2 |
| 41 | 11 |
| 42 | 22 |
| 51 | 2 |
| 52 | 0 |
| low | 0 |

## FINAL BLUE BOOK AND CHECKING PROGRAMS

ELEVUP was used to combine the horizontal and vertical blue books. Checking programs were run on the final Bfile, the Dfile and the Gfile.

## EQUIPMENT

The GPS receivers and antennas used in the project are listed below.

GPS Receivers Used

| Manuf | Model | Serial Number |
|---|---|---|
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSE | 3343A04302 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSI | 3608A14652 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSE | 3343A04305 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSE | 3403A04927 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSE | 3343A4300 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSI | 3608A14570 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSI | 3324A03158 |
| TRIMBLE | DUAL CARRIER PHASE PPSNET RS | 4508245731 |
| ASHTECH | DUAL CARRIER PHASE PPSZ-12 | 05436 |
| TRIMBLE | DUAL CARRIER PHASE PPSNET RS | 4549261225 |
| TRIMBLE | DUAL CARRIER PHASE PPS4000SSI | 3835A23672 |

GPS Antennas Used

| Model | | Serial Number |
|---|---|---|
| TRM22020.00+GP | | 0220010011 |
| TRM22020.00+GP | | 0220050496 |
| TRM22020.00+GP | | 0220010015 |
| TRM22020.00+GP | | 0220024415 |
| TRM22020.00+GP | | 0220024419 |
| TRM22020.00+GP | | 0220132680 |
| TRM22020.00+GP | | 0220050907 |
| TRM22020.00+GP | | 0220010018 |
| ASH701945E_M | SCIS | 620024509 |
| ASH701945E_M | SCIS | 620024335 |
| ASH700829.3 | SNOW | 11028 |
| TRM22020.00+GP | | 0220024412 |

# Appendix 32
# IPET Digital Leveling Specifications

**New Orleans Specific Leveling Procedures for Tidal Bench Marks – Exclusively, Second Order, Class II, for Bluebook entry into the National Geodetic Survey (NGS) Data Base.**

Interagency Performance Evaluation Team, Task 6 (IPET 6)

**NOTE: The following procedures have been established for connecting tidal bench marks to the NAVD 88 (2004.65) adjustment and are specific to the work related to the IPET. The following procedures are a mix of acceptable and non-acceptable procedures. These procedures cannot be used for any other leveling programs other than the one listed above.**

## Leveling

NOTE: All leveling will follow the guidelines as laid out below with one exception. Due to the possibility of moving around the turning points too much in the marsh areas, you will be allowed to take one setup [(mark to mark) uneven]. This is if the distance between mark to instrument (not greater than 70 meters) and instrument to mark (not greater than 70 meters) allows for a single setup. Please note that the processing program will not accept any readings that the distance exceeds the allowable, therefore it is advised that the shots be kept below 68 meters to eliminate the possibility of taking a longer shot than is required. **If the over all distance between the marks are greater than 140 meters total then even setups will be required**. **At all other tide stations you will be required to take even setups as described in item 4 for the "Running the sections (Mark to Mark)" section of this document. Adherence to these procedures, except for the allowance of single setup in the marsh area, will be followed or data will not be accepted by NGS.** All questions concerning these procedures shall be sent too or addressed to Ronnie Taylor or Brian Shannon.

Also, we want to restate something that may have not been understood. We are running second order class II procedures for the observations, but are not making the two mark tie to the NAVD 88 (2004.65) conventionally. The tie (connection) to the NAVD 88 (2004.65) is being made using GPS, therefore the tie is a GPS tie. The heights for these marks will be published as been connected by GPS and will not carry the second order class II accuracy statement, but a statement that lets everyone know the accuracy of the heights are based from a Height Modernization Mark and will be published to the nearest centimeter. The relative accuracy in difference in heights will be good to second order class II, but not the heights themselves.

# Equipment Check List

Most of the tide stations for this project are accessible only by boat. The following equipment requirements are for all gages that require access by boat. Before leaving the boat ramp, make sure the following equipment is onboard.

Equipment checklist for tide stations in the marsh

1. Digital Level
2. Stiff Leg Tripod (FIGURE 7)
3. two fiberglass rods with bull's-eye bubble
4. Thermometer (to be secured to the tripod near the instrument)
5. Brush cutting equipment
6. Sledge Hammer in marsh areas
7. 2"x 2" stakes to support the tripod legs and rod in marsh areas
8. Shovel
9. Double headed nails for turning points on 2"x 2" stakes
10. Backup sheets for recording necessary information (figure 6)

Equipment checklist for tide stations that are on solid ground

1. Digital Level
2. Stiff Leg Tripod (FIGURE 7)
3. two fiberglass rods with bull's-eye bubble – use of Barcode INVAR rods are acceptable see figure 8.
4. Thermometer (to be secured to the tripod near the instrument)
5. Brush cutting equipment
6. Hammer
7. Turning pins or turning plates if working urban area on sidewalks
8. Shovel
9. Backup sheets for recording necessary information (figure 6)

Four Concerns with leveling

1) Turning Points in the Marsh
2) Curvature
3) Refraction
4) Instrument Collimation

NOTE: Most of this information is taken directly from the U.S. Department of Commerce, "User's Guide for the Installation of Bench Marks and Leveling Requirements for Water Level Stations", October 1987.

http://140.90.121.76/publications/users_guide_for_installation_of_Bench_Mark.pdf

**1) Turning Points in Marsh Areas**
Page 25 of the User's Guide, Figure 4 illustrates the construction of posts to support the rod and level. No method can be specified beforehand for these marsh situations because of different soil conditions. Both the rod and the level must be supported on stable platforms. It is suggested to drive a two-headed nail on the stake or hub supporting the rod so the rod can simply be rotated by the rod person instead of the rod person walking around the turning point and disturbing the setup.

**2) Curvature**
The level measurement is tangent to the curved level surface of the earth. The earth curvature is approximately 8 inches (one cinder block height w/ mortar joint) per mile. The correct formula is $C_f = 0.0785\ K^2$ where $C_f$ "is earth curvature in meters and "K" is kilometers.

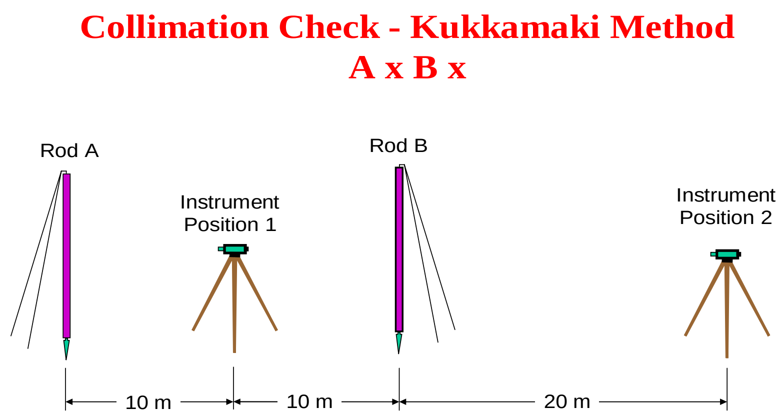
Second order, class II leveling procedures will be followed for this project with the exception of using fiberglass rods for the entire project and single setups for the stations that are in the marsh. Following is an example of the site length distance allowable for Second order, class I and II, also showing the tolerance for setup imbalance which is the same for both class I and class II. **Second order, Class I maximum length of site from rod to instrument is 60 meters and Second order, Class II maximum length of site from rod to instrument is 70 meters. Both second order, class I and second order, class II maximum difference between foresight and backsight lengths are never to exceed 5 meters per setup (although 10 meter imbalance is allowed with 3-wire leveling not spirit or digital) and 10 meters overall**

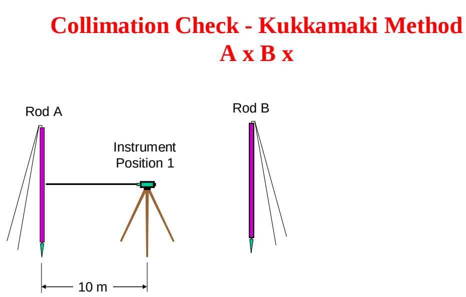
**3) Refraction**
Refraction correction either helps or compounds the curvature error by a magnitude of one-seventh (or 14%) of the earth curvature. During the day, the denser air is above the earth because the air is cooler with altitude. This is mentioned in the literature as a negative temperature gradient – i.e. during the day the temperature drops approximately 3.5 degrees Fahrenheit per thousand feet of altitude. During the night, refraction compounds the curvature error because the earth cools faster than the air above it - i.e. a positive temperature gradient.

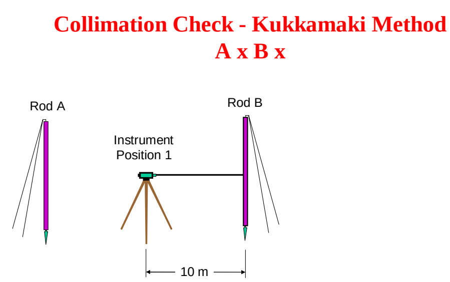
For these reasons above, temperature is recorded during geodetic surveys. Tripod heights are well above the ground and rod shots are never below half (0.5) meter from the bottom of the rod. The exception is when a monument may be located on say a gravity structure that can only be measured from a high setup reading a few centimeters of rod above the monument.

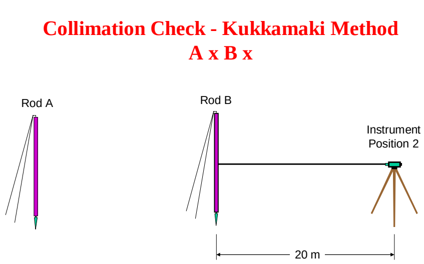
## 5) Collimation

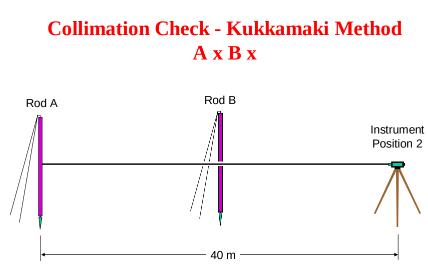
The first task upon reaching the station and setting the Vertical Control Survey in motion to connect to the GPS survey in motion should be to remove the level instrument from the case and set it on the tripod while getting everything ready for the "C" shot (collimation check). This will allow the instrument to stabilize (acclimatize). The Kukkamaki Method is the recommended method to be used for this project. The 5 figures below show the complete setup for a "C" shot and then the sequence of observation.



NOTE: A new c-shot (collimation) shall be taken at the beginning of each day or when leveling is to begin at a different tide station. Example; you start the day at gage xxx yyyy and complete the survey. Then you move to gage xxx zzzz, a new c-shot (collimation) must be taken for gage xxx zzzz. This is required for several reasons, but primarily due to having a required c-shot for each project. Each gage site relative survey will be considered a separate subproject.

The collimation of the instrument should not exceed 10 arc seconds. After the collimation has been completed you must write the collimation on the backup sheets (figure 6) along with other required information. A sample of the backup sheet follows. **The header, code 1 and code 2 only have to be filled out at the beginning of the day,** if there is a change in observer, change in equipment, etc. otherwise after the first section only the code 11 and code 99 information has to be completed. The form also allows for the computation to ensure that the sections close.

Running the sections (Mark to Mark);

A section is beginning on one mark and ending on another mark (turning points are only holders of the height difference to be transferred). A separate handout is provided for setting the level instrument up and on how to code the instruments. Each manufacture has a slightly different way of coding the instrument. Each section must have the following:

1. Before running the section fill code 11 out on the backup sheets and the code (key) in the instrument. **NOTE: SEE SECTION 13 FOR SEQUENCE OF CODE TO BE ENTERED.**

2. Always make sure that the starting height in the instrument is 0.00000, this is because we are running differences in heights not heights (elevations)

3. Always run the instrument in the BF (backsight/foresight) format

4. Always begin with rod one on the mark and end with rod one on the mark (even set-ups.

5. Always level the instrument in the direction of the back rod.

**6.** Always read the back rod first then turn and read the front rod (never let the back rod person move until the front rod reading has been completed).

**7.** Before the reading on the ending mark make sure you key the DEFINE BARCODE SPSN (SSN) in the instrument. You will have to remember the number of setups the instrument was showing and add one since the SPSN will replace the setup number. SPSN stands for survey point serial number this number is assigned to a mark and is used in the description program, leveling processing, and the abstract. The SPSN should be assigned when the recon is done and the descriptions are written. This way the observing crew will have the SPSN prior to running the levels.

**8.** The number 1 rod person (always on the mark) will call out the stamping on the mark before the observations are taken to ensure that the correct mark is being observed. If it is a different mark the recorder can write it down on the backup sheet correctly. **NOTE: the 99 record is never completed until the rod person calls out the stamping on the mark they are about to set the rod on.**

9. After the section has been closed out you will begin the next section by filling out another backup sheet. Remember after the first section only the code 11 and code 99 records have to be completed at the beginning and ending of the section.

**10.** If this is the second run for the section (both forward and backward are closed out) the form has a block at the bottom of the page which allows you to check to see if the section (forward and backward runs) checks. **NOTE: if one section is less than 0.10 kilometer distance or one setup, the section closure allowable is 1 mm. If the shortest distance of the section is more than 0.10 kilometer and multiple setups, then you multiply the square root of the km distance and multiply that times the allowable, which in the case of using the fiber glass rods would be second order class II, 8 mm times the square root of the shortest km distance. If you are using INVAR rods then we will be doing second order class I and the closure would be 6 mm times the square root of the shortest km distance.**

11. At the end of the day, after the last section a code 9999 shall be entered. This will let the processor know that the day has ended and to look for a new collimation check and code 1 and 2 record for the next day.

12. Processing the data:
Download the WinDesc and Translev program from the following site: http://www.ngs.noaa.gov/PC_PROD/PARTNERS/index.shtml. These are the programs that are used to produce the description file (WinDesc) and to process the bar code digital level data (Translev). These programs will put everything into a blue book format for submittal to NGS. Translev will process the level data and let you know what problems may exist. **Beware only the code records, code 1, 2, 11, 33, 99 can be changed or corrected based on the backup sheets. No data streams can be altered, if alter the project will be returned as being unacceptable. Before you start processing a days work create a folder that will hold the original data as it came from the instrument, then create a working directory which will hold the data that you will process. Both the processed files and the original data will be submitted. A list of what has to be submitted will follow.**

13. Leveling Procedural "Codes"

**Code 1 Entered at the beginning of the day, change in observer, or change in instrument**

**Code 2 Entered at the beginning of the day or change in level instrument or level rods**

**Code 11 Entered at the beginning of each section**

**Code 22 Will reject a previous backsight and foresight**

**Code 33 Temperature code inserted after each set-up if recording gradient temperatures**

**Code 99 Entered at the end of a section**

**Code 9999 Entered at the end of the day or change of observer or equipment**

14. SHORT LIST OF RULES;

**NEVER SET UP ON ASPHALT**

**DOUBLE RUN EVERYTHING**

**NEVER READ BELOW 0.5 METER ON THE ROD (EXCEPTION IS WHEN MARK IS SET ON A STRUTURE THAT IS WELL ABOVE THE GROUD, SUCH AS THE GUARD RAIL OF A BRIDGE)**

**ALL 3 CROSSHAIRS MUST BE ON THE ROD**

**SAME ROD ON BEGINNING AND ENDING BENCH MARKS**

**USE HAMMER AND PINS AS TURNING POINTS (SOME EXCEPTIONS WILL BE MADE AS STATED IN SOW)**

**ALWAYS KEEP A HAND ON THE LEVEL ROD WHEN SET UP**

**DO NOT TAKE ROD OFF TURNING POINT AFTER THE HEIGHTS HAVE BEEN TRANSFERRED TO YOUR TURNING (ONLY TAKE OFF AFTER THE OBSERVER HAS TRANSFERRED THE HEIGHT DIFFERENCE FROM THE BACK ROD TO THE FRONT ROD AND THE OBSERVER GIVES THE BACK ROD PERSON THE OK TO MOVE AHEAD)**

**KEEP SETUP IMBALANCE AT A MINIMUM (BY KEEP THE IMBALANCE AT A MINIMUM SEVERAL POTENTIAL CORRECTIONS WILL BE CANCELED OUT, SUCH AS CURVATURE)**

**ALWAYS COMPLETE THE LEVELING IN ONE DIRECTION ALL THE WAY THROUGH ALL THE TIDAL MARKS BEFORE RUNNING THE SECTIONS BACK. (AS AN EXAMPLE: NEVER RUN TIDAL A TO TIDAL B AND TURN AROUND AND RUN IT BACK AND THEN MOVE TO TIDAL B AND RUN TO TIDAL C AND BACK. ALWAYS RUN TIDAL A TO TIDAL B, THEN TIDAL B TO TIDAL C, THEN TIDAL C TO TIDAL D, AND TIDAL D TO TIDAL E. THEN TURN AROUND AND RUN THE SECTIONS BACK TIDAL E TO TIDAL D, TIDAL D TO TIDAL C, TIDAL C TO TIDAL B, AND TIDAL B TO TIDAL).**

**THE FOLLOWING IS A NON ACCEPTABLE PROCEDURE AND WILL NOT BE ACCEPTED, NEVER SET THE INSTRUMENT UP IN ONE SPOT AND TAKE ALL THE READINGS FROM THE SAME LOCATION. FOR THE STATIONS IN THE MARSH WHERE ONE SETUP IS BEING ALLOWED YOU STILL HAVE TO COMPLETE THE LEVELING AS MENTIONED ABOVE AND ON THE SECOND (BACKWARD) RUN YOU WILL HAVE TO RESET THE INSTRUMENT (BREAK DOWN AND RESET). IF YOU ARE RUN ON ANY OF THE DRIVE TOO MARKS TWO SETUPS ARE REQUIRED THEREFORE MOVEING THE INSTRUMENT IS ALSO A MUST.**

| PRECISE DIGITAL LEVELING – BACKUP RECORDING SHEET | | | |
|---|---|---|---|
| LINE | PROJECT | FILENAME | PAGE |
| **L-** | | | OF |

| SURVEY ORDER | SURVEY CLASS | TIME ZONE CODE | TEMP PROBE TOP HGT | TEMP PROBE BOTTOM HGT |
|---|---|---|---|---|
| | | | M | M |

**CODE 1** – BEGINNING OF DAY OR CHANGE IN OBSERVER / EQUIPMENT

| **INFO 1** DATE (MMDDYY) | **INFO 2** OBSERVER # | OBSERVER INITIALS | **INFO 3** INST TYPE | **INFO 4** TEMP CODE |
|---|---|---|---|---|
| | | | | |

**CODE 2** – EQUIPMENT USED

| **INFO 1** INST S/N | **INFO 2** COLLIMATION ” | ROD CODE | **INFO 3** ROD 1 S/N | **INFO 4** ROD 2 S/N |
|---|---|---|---|---|
| | | | | |

**CODE 11** – BEGINNING SECTION INFORMATION

| SPSN # | BENCH MARK STAMPING | **INFO 1** TIME | **INFO 2** ROD/MK | **INFO 3** TEMP | **DIR** F / B |
|---|---|---|---|---|---|
| | | | | | |

**CODE 99** – ENDING SECTION INFORMATION

| SPSN # | BENCH MARK STAMPING | **INFO 1** TIME | **INFO 2** ROD/MK | **INFO 3** TEMP | **INFO 4** W / S |
|---|---|---|---|---|---|
| | | | | | |

SECTION OBSERVATION INFORMATION

| TOTAL SETUPS | TOTAL DISTANCE (KM) | ACCUMULATED IMBALANCE (M) | ELEV DIFFERENCE (M) |
|---|---|---|---|
| | | | |

| | **CLOSURE** | **REMARKS** |
|---|---|---|
| **F** | | |
| **B** | | |
| **DIF** | | |
| **ALW’D** | | |

FIGURE 6 BACKUP RECORDING SHEET


FIGURE 7 STIFF LEG TRIPOD


FIGURE 8 INVAR ROD

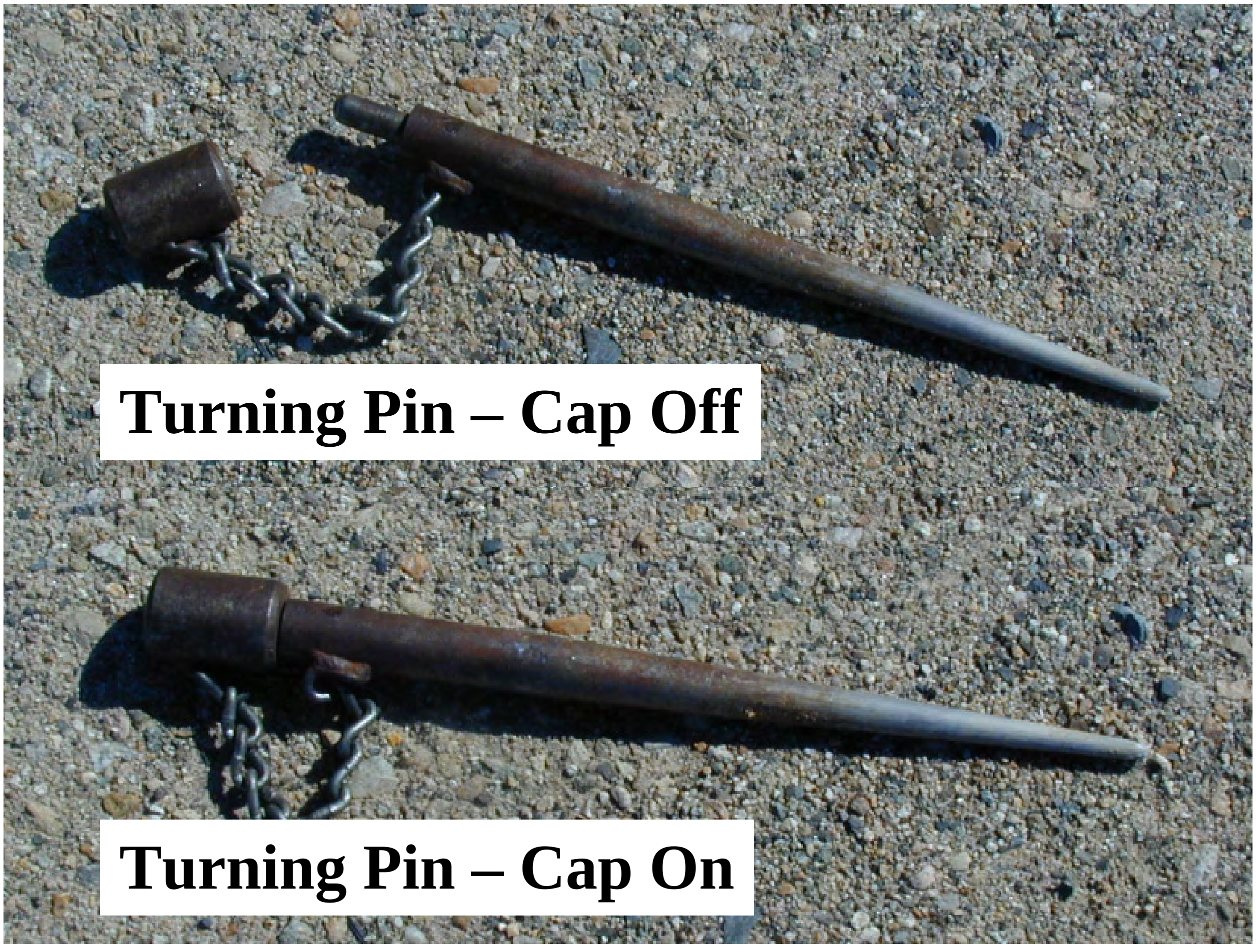



FIGURE 9 TURNING PINS

Page 10 of 10

# Appendix 33
# IPET Survey Task Order–Contract Scope of Work-20 Nov 05

# ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 12

1. CONTRACT/PURCH. ORDER/ AGREEMENT NO.: W912P9-06-D-0508
2. DELIVERY ORDER/ CALL NO.: 0001
3. DATE OF ORDER/CALL (YYYYMMMDD): 2005 Dec 05
4. REQ./ PURCH. REQUEST NO.: W81C8X-5335-8160
5. PRIORITY

6. ISSUED BY — CODE W912P9
CONTRACTING DIVISION
USARMY ENGR DIST ST LOUIS
1222 SPRUCE ST RM 4.207
ST LOUIS MO 63103-2833

7. ADMINISTERED BY *(if other than 6)* — CODE
**SEE ITEM 6**

8. DELIVERY FOB
[X] DESTINATION
[ ] OTHER
(See Schedule if other)

9. CONTRACTOR — CODE 1B6Y4 — FACILITY
**NAME AND ADDRESS**
3001 INC
5525 MOUNES ST SUITE 102
NEW ORLEANS LA 70123

10. DELIVER TO FOB POINT BY (Date) *(YYYYMMMDD)*
**SEE SCHEDULE**

11. MARK IF BUSINESS IS
[ ] SMALL
[ ] SMALL DISADVANTAGED
[ ] WOMEN-OWNED

12. DISCOUNT TERMS

13. MAIL INVOICES TO THE ADDRESS IN BLOCK
See Item 15

14. SHIP TO — CODE W912P9
GEOSPATIAL ENGINEERING BRANCH
1222 SPRUCE ST
ST LOUIS MO 63103-2833

15. PAYMENT WILL BE MADE BY — CODE W912P9
USACE FINANCE CENTER
ST LOUIS DISTRICT (B3) 5722 INTEGRITY DRI
MILLINGTON TN 38054-5005

**MARK ALL PACKAGES AND PAPERS WITH IDENTIFICATION NUMBERS IN BLOCKS 1 AND 2.**

16. TYPE OF ORDER

| | | |
|---|---|---|
| DELIVERY/ CALL | X | This delivery order/call is issued on another Government agency or in accordance with and subject to terms and conditions of above numbered contract. |
| PURCHASE | | Reference your quote dated<br>Furnish the following on terms specified herein. REF: |

ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.

NAME OF CONTRACTOR | SIGNATURE | TYPED NAME AND TITLE | DATE SIGNED *(YYYYMMMDD)*

[ ] If this box is marked, supplier must sign Acceptance and return the following number of copies:

17. ACCOUNTING AND APPROPRIATION DATA/ LOCAL USE

**See Schedule**

| 18. ITEM NO. | 19. SCHEDULE OF SUPPLIES/ SERVICES | 20. QUANTITY ORDERED/ ACCEPTED* | 21. UNIT | 22. UNIT PRICE | 23. AMOUNT |
|---|---|---|---|---|---|
| | **SEE SCHEDULE** | | | | |

* *If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle.*

24. UNITED STATES OF AMERICA
TEL: 314-331-8505
EMAIL: A
BY: ARCHIE C. RINGGENBERG
Archie C Ringgenberg
CONTRACTING / ORDERING OFFICER

25. TOTAL: $287,381.00
26. DIFFERENCES

27a. QUANTITY IN COLUMN 20 HAS BEEN
[ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
c. DATE *(YYYYMMMDD)*
d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE
28. SHIP NO.
29. DO VOUCHER NO.
30. INITIALS

[ ] PARTIAL
[ ] FINAL

f. TELEPHONE NUMBER
g. E-MAIL ADDRESS

32. PAID BY
33. AMOUNT VERIFIED CORRECT FOR

**36. I certify this account is correct and proper for payment.**
a. DATE *(YYYYMMMDD)*
b. SIGNATURE AND TITLE OF CERTIFYING OFFICER

31. PAYMENT
[ ] COMPLETE
[ ] PARTIAL
[ ] FINAL

34. CHECK NUMBER
35. BILL OF LADING NO.

37. RECEIVED AT
38. RECEIVED BY
39. DATE RECEIVED *(YYYYMMMDD)*
40. TOTAL CONTAINERS
41. S/R ACCOUNT NO.
42. S/R VOUCHER NO.

**DD Form 1155, DEC 2001** PREVIOUS EDITION IS OBSOLETE.

Section B - Supplies or Services and Prices

SCOPE OF WORK

29 November 2005

Interagency Performance Evaluation Team (IPET) for New Orleans and vicinity Hurricane Protection System

Task Group No. 6--Vertical Datum Elevation Modeling

GEODETIC CONTROL AND TOPOGRAPHIC SURVEYS OF SE LOUISIANA HURRICANE PROTECTION AND FLOOD CONTROL PROJECTS

3001,Inc
W912P9-06-D-0508

SCOPE OF WORK

1. LOCATION OF WORK. Geodetic control and topographic surveys will be performed in greater New Orleans and SE Louisiana (Orleans, Jefferson, St. Bernard, St. Charles, and Plaquemines Parishes), on hurricane protection and flood protection projects in and around (but not limited to) the following projects:

Lake Pontchartrain, LA and Vicinity Hurricane Protection Project (HPP)

The New Orleans to Venice, LA, HPP

The West Bank and Vicinity, New Orleans, LA, HPP

The Grande Isle and Vicinity (Larose to Vicinity of Golden Meadow) HPP

The Grand Isle and Vicinity LA, HPP

Mississippi River and Tributaries Flood Control Project (MRTFCP)

2. GENERAL PURPOSE OF SURVEYS. Geodetic and topographic surveys performed under this assignment are required to support other IPET Task Groups evaluating the performance of the existing (pre-Katrina) Federal hurricane protection system. These data will be used in hydrodynamic models and for other purposes—including support for Task Force Guardian. Since data obtained under this assignment will be used in forensic modeling, time is of the essence for completion of this work.

3. SURVEYING SERVICES TO BE PROVIDED. The services to be rendered by the Contractor shall include performance of precise vertical geodetic control surveys, topographic surveys, data analysis and adjustment, and related CADD functions. Three 4-man fully equipped conventional and GPS survey crews, each capable of performing four simultaneous static GPS occupations may be necessary. Under this task order, each field crew must possess the necessary materials and means to perform geodetic and topographic surveys as directed. An overall survey coordinator and/or survey computer shall be required for near real-time data reduction, adjustment, and submittal. Each field survey crew shall have the personnel, capability, and full survey equipment (such as fixed height tripods, dual frequency receivers, total stations, precision differential levels, calibrated invar rods, etc.…) to perform the following types of surveys:

- Static DGPS Surveys (2 cm elevation accuracy determinations)
- Real-Time Kinematic Elevation Surveys
- Total Station Topography
- Differential Leveling (Second-Order, Class II)

One or more small (16-19 ft) skiff(s) with outboard motor may be required to reach some of the remote sites.

**See Appendix A for specific details on performing surveys related to Phase 1a.*

3.a. Government Furnished Information. The Government shall provide the following information to the contractor at the field site:

- List of Approved NGS Benchmarks for Primary Control;
- List of Benchmarks/Control Marks to be Surveyed;
- List of Tidal Benchmarks to be Surveyed and Tied to;
- Required Control Mark/Benchmark Description Form (Template)
- Detailed Maps of the Project Area
- Network Design Plan for DGPS Observations
- Submittal Criteria
- Template form for the submittal of data
- Pump station locations (1st Floor & invert elevations)
- Bridge surveys (floodwall & lower chord elevations and/or topo)
- Aerial/LIDAR mapping QC check points
- Floodwall and levee elevation and/or topo surveys

4. COMPLIANCE. All Surveying and Mapping products and related work shall be in strict compliance with the applicable Corps of Engineers Engineering Manuals and with related geodetic control technical standards and publications published by the National Geodetic Survey and the Federal Geodetic Control Subcommittee.

5. REFERENCED STANDARDS AND SPECIFICATIONS. The following standards and specifications shall be followed in performing various phases of the work. USACE IPET Task Group 6 personnel will only make exceptions and/or modifications to these criteria.

ER 1110-1-8156
Policies, Guidance, and Requirements for Geospatial Data and Systems

FM 3-34.331
Topographic Surveying

EM 1110-1-1000
Photogrammetric Mapping

EM 1110-1-1002
Survey Markers and Monumentation

EM 1110-1-1003
NAVSTAR Global Positioning System Surveying

EM 1110-1-1005
Control and Topographic Surveying (Draft) – Includes New Orleans District data submittal formats.

EM 1110-1-2909
Geospatial Data and Systems

FGDC 1998a
"Geospatial Positioning Accuracy Standards, PART 1: Reporting Methodology," Federal Geographic Data Committee, FGDC-STD-007.1-1998

FGDC 1998b
"Geospatial Positioning Accuracy Standards, PART 2: Standards for Geodetic Networks," Federal Geographic Data Committee, FGDC-STD-007.2-1998

FGDC 1998c
"Geospatial Positioning Accuracy Standards, PART 3: National Standard for Spatial Data Accuracy," Federal Geographic Data Committee, FGDC-STD-007.3-1998

FGDC 1998d
"Content Standard for Digital Geospatial Metadata (Version 2.0)," Federal Geographic Data Committee, FGDC-STD-001-1998

FGDC 2002
"Geospatial Positioning Accuracy Standards, PART 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management," Federal Geographic Data Committee, FGDC-STD-007.4-2002

FGCS 1984
Federal Geodetic Control Subcommittee 1984
"Standards and Specifications for Geodetic Control Networks," Rockville, MD.

FGCS 1988
Federal Geodetic Control Subcommittee 1988
"Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques (Preliminary)", Rockville, MD. (Reprinted with Corrections: 1 Aug 1989).

NGS 1988
National Geodetic Survey 1988
"Guidelines for Submitting GPS Relative Positioning Data to the National Geodetic Survey"

NOAA 1994
"Input Formats and Specifications of the National Geodetic Survey Data Base," NOAA, National Geodetic Survey, September 1994.

NOAA 1997
NOAA Technical Memorandum NOS NGS-58, Zilkoski, D.B., D'Onofrio, J. D., and Frankes, S. J. (Nov 1997) "Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm)," Version 4.1.3. Silver Spring, Maryland.

NOAA 2005
Guidelines for establishing GPS derived orthometric heights (standards: 2cm and 5cm) version 1.4, National Geodetic Survey 2005 DRAFT

6. SURVEY SPECIFICATIONS.

Static DGPS Surveys. The primary control network consisting of approximately thirty points shall be performed to NGS Bluebook specifications, as directed in the network design plan as provided by the Government on site. Structure reference points, as stated in the network design plan, will not be bluebooked. The contractor shall follow detailed guidance contained in NOAA 2005 for all 2-cm accuracy GPS differential height surveys. This guidance is supplemented by the criteria in EM 1110-1-1003. All static GPS survey network designs shall be approved in advance by the NGS Representative on Task Group 6. All ties shall be relative to the NAVD88 (VTDP 2004) benchmark network.

RTK Surveys. Supplemental RTK elevation surveys to various structures shall follow the guidance in EM 1110-1-1003. Equivalent Third-Order accuracy elevations are required on flood control structures. Follow standards and specifications in EM 1110-1-1005 for fieldwork, metadata formats, and New Orleans District specific submittal formats.

Differential Leveling Surveys. Follow procedural guidance for Second-Order, Class II differential leveling in EM 1110-1-1005.

Topographic Surveys. (Total Station & Data Collector). Follow guidance outlined in EM 1110-1-1005.

7. TASK 6 POINTS OF CONTACT. The primary IPET (Task 6) points of contact for this work are:

Mr. Mark Huber (New Orleans District)504-931-5949
Mr. Robert Mesko (St. Louis District)314-630-5815
Mr. Jeff Navaille (Jacksonville District)904-232-2499
Mr. Bill Bergen (HQ, USACE) 904-534-6980
Mr. James Garster (Topographic Engineering Center) 703-428-9026
Mr. Ronnie Taylor (National Geodetic Survey) 850-294-3072

Additional contact information (e.g., e-mail addresses) will be furnished upon award or commencement of work. Close coordination with these personnel is emphasized given the need to prioritize structure surveys.

8. WORK ASSIGNMENTS. Specific GPS and topographic surveys of flood/hurricane protection structures will be assigned by IPET Task Group 6 personnel in the New Orleans District office. These surveys will be phased based on prioritization requirements from the various hydrodynamic modeling Task Groups under the IPET. Daily field coordination with Task Group 6 points of contact shall be made in order to expedite survey tasks. Static DGPS surveys require coordination and approval by the NGS Representative in Task Group 6.

9. DATA PROCESSING AND SUBMITTAL. Given the critical urgency of this data collection effort, observed field data will be processed and adjusted (preliminary values) on site. The Contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. Compute and tabulate the horizontal and vertical positions on all work performed. The survey Contractor shall furnish data (raw data files in native format and RINEX, log sheets, obstruction charts and other field notes) directly to the Task 6 team in the New Orleans District Office within 24 hours after the survey data is collected in the field. The data shall be processed, adjusted and submitted within 48 hours of field collection. Static DGPS survey observations will be readjusted by the NGS. RTK, leveling, and topographic data collection formats shall conform to the criteria in EM 1110-1-1005, including those required by the New Orleans District. Digital data shall be submitted on Recordable (CD-R) Compact Disk, media. Compact Disk, Rewritable (CD-RW) will not be accepted.

a. The survey Contractor shall furnish any and all data requested by the POC's listed above, this includes the COPIES OF THE FIELD BOOKS, HARD COPY MAPS, DIGITAL FILES (X, Y, Z, DGN, OR DTM. All data (copies or plots) shall be stamped with a disclaimer such as PRELIMINARY OR ADVANCE COPY, FOR FIELD REVIEW ONLY, SUBJECT TO CORRECTIONS.

b. The following is a list of files that shall be submitted, as applicable to the particular type of geodetic/topographic survey work performed at a particular hurricane protection structure:

Raw data files (GPS or topographic data collector)
Adobe Acrobat pdf files of all field notes
XYZ ASCII files (unsorted, EM format w/ embedded metadata)
DGN design files
DTM surface files

ALG alignment files
TML template files
RWL roadway files
Readme files that explicitly detail the files submitted
Daily Log of survey activities at the project site

c. The final data shall be submitted on CD-ROM at the conclusion of the project and under the direction of the New Orleans District Survey Section, a final project CD will be compiled and submitted. The CD will contain all of the partial project data sets in addition to a final overall set of files for the project (single overall DGN, etc.).

10. DIGITAL GEOSPATIAL METADATA. Metadata are "data about data". Metadata describes the content, identification, data quality, spatial data organization, spatial reference, entity and attribute information, distribution, metadata reference, and other characteristics of data. Each survey project shall have metadata submitted with the final data submittal. All metadata submitted must be compliant with the Federal Geographic Data Committee Standard "Content Standard for Digital Geospatial Metadata", FGDC-STD-001-1998. This standard is available for download from www.fgdc.gov. A graphical, annotated workbook explaining the standard is available in PDF format at www.fgdc.gov. Corpsmet95 is available for download from www.corpsgeo1.usace.army.mil, and may be used to prepare metadata. All sections applicable to this collection effort must be completed.

11. CADD. Where required, topographic survey data shall be provided in 3D design files in Microstation V8.

a. GLOBAL ORIGIN. The design files shall have a global origin of 0, 0, 2147483.65. Design file working units shall be set to US Feet with the label set to FT. Drawing file names will be based on and named for the site surveyed or as directed by the District Office.

b. DIGITAL TERRAIN MODEL (DTM) DATA. The Contractor shall develop and deliver a surface model of the survey area using Intergraph compatible Digital Terrain Modeling software and the model file shall have the .dtm extension. The digital terrain model shall be developed from the collected data. Breaklines should include ridges, drainage, road edges, surface water boundaries, and other linear features implying a change in slope. The surface model shall be of adequate density and quality to produce a 1-foot contour interval derived from the original DTM (Digital Terrain Model) file. The contour data shall be incorporated as a reference file into the final data set. All data used to develop the DTMs shall be delivered in Bently Microstation 3-D design files.

c. MODEL DGN FILES (SCALE 1:1).

(1) The topographic data shall be provided in one DGN file and shall be attached to the sheet files.

(2) The control/baseline data shall be provided in one DGN file and shall be attached to the sheet files.

d. COVER AND CONTROL SHEET. The first sheet shall be a cover sheet showing the control sketch, survey control tabulation, sheet layout or index, legend, project location map, survey notes, north arrow, graphic scale, grid ticks, and large signature block. Tabulate, plot, and list the horizontal control used for the survey on the final drawings.

e. PLAN SHEETS. The plan sheets shall be prepared same as Enclosure 1, in the Corps of Engineers format showing notes, title block, grid, north arrow, graphic scale, legend, sheet index. Sheets shall be oriented with north to the top. The extreme right 7 inches of the sheet shall be left blank for notes, legends, etc. The second sheet and all sheets following shall be a continuation sheet and shall have a minimum of two notes, note 1: See Drawing number 1 for notes, note 2*: Refer to Survey No. YY-YYY.*

f. SECTION VIEWS. The sections shall be extracted and displayed from the digital terrain model (DTM OR TTN) utilizing INROADS. The sections shall be generated or extracted along the same azimuth as the section was collected in the field. The sections shall be displayed at a 10 to 1 vertical exaggeration. The planimetric lines (alignment of extraction), alignment, stations, and cross sections shall be displayed in one DGN file (NO PLOTS) with the district border file attached.

12. SURVEY/QUALITY CONTROL REPORT. The Contractor shall furnish a digital (*.doc) file on the final CD. The report shall include Right-of-Entry information, Control monuments Designation recovered, destroyed, fixed, included in control network, dates of field survey collection, types of equipment used, quality control checks, and digital files. Unique circumstances and/or issues related to this survey, general approach/methodology to this survey. Along with any other data required in accordance with the law or precedent and for the Corps of Engineers to publish the results of the survey.

13. MONUMENT DESCRIPTION REPORT. The contractor shall furnish a detailed monument description sheet for each control monument set, found or otherwise used in the completion of this survey. The document *"Monument-Description-Template.doc"* provides guidance as to what type of information must be included in these reports. Among the types of information that should be included are: Station name, survey name/number, written "To Reach" navigation instructions, vicinity map, type of monument (size and setting), date set or recovered, establishing agency, datum information, adjusted position, swing ties to aid in future recovery, scanned sketches and digital photos.

14. NOT TO EXCEED. It is emphasized that the Not To Exceed amount for this Task Order is $288,000.00 and that the line item's will be identified during the negotiations for this Not to Exceed amount. The Contractor shall not provide services in excess of 85% of this total amount without first receiving written authorization from the Contracting Officer. It is the Contractor responsibility to notify this office prior to reaching 85% of the Not To Exceed amount. Payments will be made on the fixed unit prices of the task order for services performed, as reflected by DAILY TIME SHEETS submitted with the pay estimates. Upon completion of all services, if the total amount for services provided is less than the stated amount, the price of the delivery order will be modified to reflect services actually performed and accepted. To certify the hours worked and progress, a digital excel spread sheet shall be submitted on Monday of each week showing Survey crew members hours worked, work accomplished, Project Manager, Computer person, CADD person and the percentage used of the Not To Exceed amount.

15. Schedule and Submittal. All tasks (1-5) shall be completed as scheduled. All submittals including, original data sheets, maps, disk, and documentation, source code, etc. will be submitted to the Corps of Engineers, Geospatial Engineering Branch, CEMVS-ED-S, ATTN: Bob Mesko, 1222 Spruce, St. Louis, MO 63103-2833 by 30 March 2006 and shall become the sole property of the U.S. Government.

16. Time Extensions: In the event these schedules are exceeded due to causes beyond the control and without fault or negligence of the contractor, as determined by the Contracting Officer, this delivery order completion date will be extended one (1) calendar day for each day of delay. Requests for time extension for an individual task order should be forwarded to the Contracting Officer no later than fourteen (14) days preceding the completion date shown on the task order.

## Appendix A.

Specific Phase 1a Information:

Background: A GPS static survey is needed to incorporate Tidal Benchmarks into the NAVD88 (VTDP 2004) vertical control for the New Orleans area. This information will be used to tie the water datums to the geodetic datum (NAVD88 (VTDP 2004)) in support of construction activity in New Orleans. Leveling will be required between three tidal benchmarks at each tide station to verify the station vertical datum integrity. NOAA leveling standards for tidal benchmarks will be provided to the contractor. GPS static survey measurements on one of these same three benchmarks will be submitted for "Blue Book" publication into the National Geodetic Survey (NGS) database of geodetic survey monuments. This particular GPS static survey will form a GPS static network composed of four tidal benchmarks from each of the four tide stations in the survey to four control monuments with NAVD 88 (VTDP 2004) elevations. This derivative NAVD 88 datum has been developed specifically for settlement issues in

New Orleans. "VTDP" is an acronym for Vertical Time Dependent Position. Four vertical control stations are required for this survey due to the settlement problems in New Orleans. Because some of the control monuments may span a great distance from the tidal benchmarks, each GPS static survey will require four hours of occupation. Two 4-hour GPS sessions will be required to best determine the ellipsoid height of a tidal benchmark.

This GPS static survey will follow the latest NGS procedures for the vertical two-centimeter local accuracy/five centimeter absolute accuracy standards and the NGS Blue-Book Standards for incorporation of survey information into the NGS Database for NGS Data Sheet publication. The survey measurements from the geodetic primary control to the tidal benchmarks will be established as secondary control accuracy standards. A federal representative will be available in the field to monitor the fieldwork during this survey. The contractor will submit a GPS survey plan to NGS prior to going into the field. The NGS point of contact for the contractor will be Mr. Ronnie Taylor at 904.488.2427.

Access to the control stations may be accomplished by motor vehicles as well as the first two tide stations listed below in the next section of this document. The last two tide stations are accessed by boat. Two boats may be required, as the stations will be occupied by GPS equipment at the same time

The National Ocean and Atmospheric Administration (NOAA) Tide Stations to be included in a network with the four NAVD 88 (VTDP 2004) monuments are:

1) 8761487, Chef Menteur, Chef Menteur Pass
2) 8761678, Michoud Substation, ICWW
3) 8761529, Martello Castle, Lake Borgne
4) 8761305, Shell Beach, Lake Borgne

Note: Second-Order, class II, levels between at least three benchmarks at each tide station above are required. Published NOAA Bench Mark Sheets for each tide station and a sketch depicting the tidal benchmarks are included with this Scope of Work.

The GPS network for this survey has four ties to the NAVD 88 (VTDP 2004). These stations are:

1) *PIKE RESET, PID BH1164 HOR ORDER - B, VERT ORDER – FIRST CLASS I, ELLIP ORDER - FOURTH, CLASS I
2) WASTE WELL 2 RESET, PID BH1089 VERT ORDER – FIRST CLASS I
3) ALCO, PID BJ1342 HOR ORDER - B, VERT ORDER – THIRD, ELLIP ORDER - FOURTH, CLASS I
4) V 375, PID AT0760 HOR ORDER - B, VERT ORDER – FIRST CLASS II, ELLIP ORDER - FOURTH, CLASS II

NOTE: C 189, PID BH1119 was searched 15 October and 9 November 2005 with no success finding the monument.

*PIKE RESET may not be suitable for GPS (tree) based on remarks from field reconnaissance personnel on the two dates above. A suggestion made 15 October was to run levels from PIKE RESET sixty-seven feet to PIKE RM 3 (BH1160) and use this as the control elevation.

<u>Appendix 1(a)</u>

Tidal Bench Mark Reconnaissance

Perform Reconnaissance for the nine historical benchmark sites below:

1. 8761602, Lake Judge Perez, Hermitage Bayou– 7 BM's Vehicle Access.2. Bench Marks.2.Bench Marks
2. 8761484, Lease VB #4, Bayou Dulac– 5 BM's Boat Access .2. Bench Marks.2.

Bench Marks
3. 8761742, Mendicant Island, Barataria Bay– 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
4. 8761414, Billet Bay Community, Billet Bay – 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
5. 8761679, St. Marys Point, Barataria Bay– 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
6. 8761198, Chevron Station 289, Pelican Island– 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
7. 8760889, Olga Compressor Station, Grand Bay– 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
8. 8761108, Bay Gardene – 5 BM's Boat Access .2. Bench Marks.2. Bench Marks
9. 8761799, M.V. Petroleum Dock, Bayou St. Denis – 5 BM's Boat Access 3.2. Bench Marks.2. Bench Marks

The following equipment will be required to perform the procedures at each tide station:

1) Tidal Bench Mark Sheet Descriptions - look for monuments
2) Digital Camera – possible five photographs for each monument
3) surveyor's chains (or fiber glass tapes) - verify published distances of the data sheet
4) compass - verify directions of the published data sheet
5) hand-held GPS unit good to three thousands of a minute (6.076 feet ~ 6 feet) precision – locate each found tidal benchmark
6) field notebook – party chief's notes for each site (include weather info and site characteristics and possible site difficulties for GPS survey operations and leveling)
7) clip board with paper – prepare site sketch depicting the found benchmarks, GPS suitable monuments with horizon sketches.

1) Tidal Bench Mark Sheet Descriptions
The engineering firm will download the NOAA Tidal Bench Mark Sheets from the NOAA website http://www.co-ops.nos.noaa.gov/ . The government will supply the engineering firm with sketches of the above nine tide station sites to help recover the tidal benchmarks.

2) Digital Camera
Place a tripod or four to five foot jade pole with flagging over the found monument and photograph the monument in a way the captures well-defined permanent features so the monument may possibly be relocated by looking at the photograph. If no well-defined permanent features are available, then photograph the monument from the four cardinal directions, not too close, not too far away. Name the photograph with the station name and direction to the object photographed. For example, 8761799BMCtoSW.jpg or 8761799BMAtoE.jpg.

Digital photographs shall be taken showing the stamping and casting of bench mark disks (photo taken within 0.5 m to 1 m above the disk and must be legible), general location and any other major changes in a station. The digital file for a bench mark photo shall have the bench mark designation in its file name.

All digital photo files should be named such that the name of the file will indicate the station number and the type of photo taken. For example, the pressure sensor photo for DCP1 at San Francisco shall be named as 94142901 sensor N1.jpg. The bench mark photos at San Francisco showing the benchmark stamping should be named as 9414290 (designation) face.jpg.

3) surveyor's chains
Verify published distances to the monuments listed on the Tidal Bench Mark Sheet. Each found monument will typically have three references to the monument from well-defined permanent objects.

4) compass

Verify published directions to the monuments listed on the Tidal Bench Mark Sheet. Each found monument will typically have three references to the monument from well-defined permanent objects.

5) hand-held GPS unit
Use a hand-held GPS unit good to three thousands of a minute (6.076 feet ~ 6 feet) precision. Locate each found tidal benchmark.

6) field notebook
Party chief's notes for each site shall include: weather information, site characteristics, possible site difficulties for GPS survey operations, possible site difficulties for leveling, and survey personnel present.

7) clip board with paper
Prepare site sketch depicting the found benchmarks. Prepare a sketch for the most GPS suitable monument at each tide station with a horizon sketch depicting obstacles for GPS signals. NOAA has historically used 8"x11" paper for these sketches, so do not put the sketches in a field notebook. The government will forward tide station sketches that may be used to as a guide for the contractor's sketch.

| ITEM NO | SUPPLIES/SERVICES | QUANTITY | UNIT | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|
| 0001 | | 1 | Lump Sum | | $287,381.00 |

Project: Geodetic Control and Topographic Surveys of SE Louisiana - Hurricane Protection and Flood Control Projects

Section F - Deliveries or Performance

## DELIVERY INFORMATION

| COMPLETION DATE | POC ADDRESS |
|---|---|
| 30-MAR-2006 | US ARMY CORPS OF ENGINEERS<br>ST LOUIS DISTRICT<br>GEOSPATIAL ENGINEERING BRANCH<br>ATTN DANNY MCMURPHY (314) 331-8389<br>1222 SPRUCE ST<br>ST LOUIS MO 63103-2833<br><br>FOB: Destination |

Section G - Contract Administration Data

## ACCOUNTING AND APPROPRIATION DATA

| | | | | |
|---|---|---|---|---|
| AA: | 96X31250000 082413 | 3230LG72J6099993 | NA | 96233 |
| COST CODE: | 000000000000 | | | |
| AMOUNT: | $287,381.00 | | | |

# Appendix 34
# NAVD88 ETL 1110-1-152 1994

CECW-EP

**DEPARTMENT OF THE ARMY**
**U. S. Army Corps of Engineers**
**Washington, D.C. 20314-1000**

ETL 1110-1-152

Technical Letter
No. 1110-1-152

1 January 1994

## Engineering and Design
## CONVERSION TO THE NORTH AMERICAN VERTICAL DATUM OF 1988

### 1. Purpose

This technical letter provides technical guidance and implementation procedures for the conversion from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88).

### 2. Applicability

This letter is applicable to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having responsibility for civil works, military construction, or environmental restoration projects.

### 3. References

*a.* Water Resources Development Act of 1992 (WRDA 92), Section 224, Channel Depths and Dimensions.

*b.* EM 1110-2-1003, Hydrographic Surveying.

*c.* Converting the National Flood Insurance Program to the North American Vertical Datum of 1988: Guidelines for Community Officials, Engineers, and Surveyors, FEMA Report No. FIA-20, June 1992.

*d.* Results of the General Adjustment of the North American Datum of 1988, American Congress on Surveying and Mapping Journal of Surveying and Land Information Systems, Vol. 52, No. 3, 1992, pp. 133-149.

*e.* American Congress on Surveying and Mapping Ad Hoc Committee Report on NAVD88, Special ACSM Report, 1990.

### 4. Discussion

*a.* NGVD29 has been replaced by NAVD88, an international datum adopted for use in Canada, the United States and Mexico. NAVD88 was established to resolve problems and discrepancies in NGVD29. The adjustment of NAVD88 was completed in June 1991 by the National Geodetic Survey (NGS), an agency of the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). NAVD88 was constrained by holding fixed the height of a single primary tidal benchmark (BM) at Father's Point/Rimouski, Québec, Canada, and performing a minimally constrained general adjustment of U.S.-Canadian-Mexican leveling observations. The result of this adjustment is newly published NAVD88 elevation values for benchmarks (BMs) in the NGS inventory. Most Third-Order BMs, including those of other Federal, state and local government agencies, were not included in the NAVD88 adjustment. Appendix A contains further background information on the development and adjustment of NAVD88.

*b.* The Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC) has affirmed that NAVD88 shall be the official vertical reference datum for the U.S. The FGDC has prescribed that all surveying and mapping activities performed or financed by the Federal Government make every effort to begin an orderly transition to NAVD88, where practicable and feasible.

*c.* Both tidal and non-tidal low water reference planes and datums are affected by the change to NAVD88. The datum for the Great Lakes is now the International Great Lakes Datum of 1985 (IGLD85). Unlike the prior datum (IGLD55), IGLD85 has been directly referenced to NAVD88 and originates at the same point as NAVD88. Elevations of reference points/datums along the various inland waterway systems will also be impacted by the change in datums.

*d.* The transition to NAVD88 may have considerable impact on Corps projects, including maps, drawings, and other spatial data products representing those projects. However, once completed, the transition will result in a more accurate vertical reference datum that has removed leveling errors, accounts for subsidence, and other changes in elevation.

*e.* A computer program entitled "VERTCON 1.0" can be used to make approximate conversions between NGVD29 and NAVD88. This program was developed by NGS and during the later part of FY94 will be incorporated into the USACE program CORPSCON. VERTCON conversions are intended for general small-scale mapping uses -- VERTCON should not be used for converting benchmark elevations used for site plan design or construction applications. Further details on VERTCON are at Appendix A.

## 5. Action

*a.* USACE commands should begin the orderly transition to NAVD88. Procedural guidance for performing this conversion is given in Appendix A.

*b.* The conversion to NAVD88 should be accomplished on a project by project basis. The relationship of all project datums to both NGVD29 and NAVD88 will be clearly noted on all drawings, charts, maps, and elevation data files.

*c.* In accordance with Section 24 of WRDA 92, when elevations are referred to a tidal reference plane in coastal waters of the U.S., Mean Lower Low Water (MLLW) shall be used as the vertical datum. Tidal BMs should be tied to NAVD88 instead of NGVD29 where NAVD88 data is available. Tidal datums shall be established in accordance with the procedures outlined in EM 1110-2-1003.

*d.* Other hydraulic-based reference planes established by USACE for the various inland waterways, reservoirs, and pools between control structures should continue to be used for consistency; however, they should also be connected with the NAVD88 where practicable and feasible.

*e.* In project areas where local municipal or sanitary jurisdictions have established their own vertical reference planes, every attempt should be made to obtain the relationship between that local datum and NGVD29 and/or NAVD88; and clearly note this relationship on all drawings, charts, maps, and elevation data files.

## 5. Technical Assistance

The U.S. Army Topographic Engineering Center (USATEC) may be consulted if technical assistance is required in the conversion effort. Contact Commander and Director, USATEC, ATTN: CETEC-TL-SP, Building 2592, Fort Belvoir, VA 22060-5546. The HQUSACE proponent for this action is the Engineering Division, Directorate of Civil Works, ATTN: CECW-EP-S.

FOR THE DIRECTOR OF CIVIL WORKS:

1 Appendix
APP A - Development and Implementation of NAVD88

PAUL D. BARBER
Chief, Engineering Division
Directorate of Civil Works

# APPENDIX A
# DEVELOPMENT AND IMPLEMENTATION OF NAVD88

## SECTION I
## Background

### 1. General

*a.* The NAVD88 is a new vertical datum for North America which effectively covers Canada, Mexico, and the U.S. The new adjustment of the U.S. National Vertical Control Network (NVCN) was authorized in 1978, and in 1982 the National Oceanic and Atmospheric Administration (NOAA) and Canada signed a Memorandum of Understanding (MOU) regarding the adoption of a common, international vertical control network called the NAVD88.

*b.* The Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC) has adopted the new NAVD88 datum. In addition, NAVD88 was established in conjunction with the International Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data. This committee defined the IGLD85 which was published for use in January 1992. IGLD85 replaced IGLD55.

### 2. The National Vertical Control Network (NVCN): NGVD29 and NAVD88

*a.* The NVCN consists of a hierarchy of interrelated nets which span the United States. Before the adoption of NAVD88, benchmark (BM) elevations of the NVCN were published as orthometric heights referenced to NGVD29. NGVD29 was established by the United States Coast and Geodetic Survey's (USC&GS's) 1929 General Adjustment. NGVD29 was established by constraining the combined U.S. and Canadian first order leveling nets to conform to Mean Sea Level (MSL) as determined at 26 long term tidal gage stations that were spaced along the east and west coast of North American and along the Gulf of Mexico, with 21 stations in the U.S. and 5 stations in Canada.

*b.* Local MSL is a vertical datum of reference that is based upon the observations from one or more tidal gaging stations. NGVD29 was based upon the assumption that local MSL at those 21 tidal stations in the U.S. and 5 tidal stations in Canada equalled 0.0000 foot on NGVD29. The value of MSL as measured over the Metonic cycle of 19 years shows that this assumption is not entirely valid and that MSL varies from station to station.

*c.* The NGVD29 was originally named the Mean Sea Level Datum of 1929. It was known at the time that because of the variation of ocean currents, prevailing winds, barometric pressures and other physical causes, the MSL determinations at the tide gages would not define a single equipotential surface. The name of the datum was changed from the Mean Sea Level Datum to the NGVD29 in 1973 to eliminate the reference to sea level in the title. This was a change in name only; the definition of the datum established in 1929 was not changed. Since NGVD29 was established, it has become obvious that the geoid based upon local mean tidal observations would change with each measurement cycle. Estimating the geoid based upon the constantly changing tides does not provide the most stable estimate of the shape of the geoid, or the basic shape of the Earth.

*d.* The datum for NAVD88 is based upon the mass or density of the Earth instead of the varying heights of the seas. Measurements in the acceleration of gravity are made at observation points in the network and only one datum point, at Pointe-au-Pere/Rimouski, Québec, Canada, is used. The vertical reference surface is therefore defined by the surface on which the gravity values are equal to the control point value. Although the international cooperation between the United States and Canada greatly strengthened the 1929 network, Canada did not adopt the 1929 vertical datum. The NGVD29 was strictly a national datum. NAVD88 is an international vertical datum for the US, Canada, and Mexico.

### 3. Distinction Between Orthometric and Dynamic Heights

*a.* There are several different reference elevation systems used by the surveying and mapping community. Two of these height systems are relevant to IGLD85: orthometric heights and dynamic heights. Geopotential numbers relate these two systems to each other. The geopotential number (C) of a BM is the difference in potential measured from the reference geopotential surface to the equipotential surface passing through the survey mark. In other words, it is the amount of work required to raise a unit mass of 1 kg against gravity through the orthometric height to the mark. Geopotential differences are differences in potential which indicate hydraulic head. The orthometric height of a mark is the distance from the reference surface to the mark, measured along the line perpendicular to every equipotential surface in between. A series of equipotential surfaces can be used to represent the gravity field. One of these surfaces is specified as the reference system from which orthometric heights are measured. These surfaces defined by the gravity field are not parallel surfaces because of the rotation of the earth and gravity anomalies in the gravity field. Two points, therefore, could have the same potential but may have two different orthometric heights. The value of orthometric height at a point depends on all the equipotential surfaces beneath that point.

*b.* The orthometric height (H) and the geopotential number (C) are related through the following equation:

$$C = G * H$$

where G is the gravity value estimated for a particular system. Height systems are called different names depending on the gravity value (G) selected. When G is computed using the Helmert height reduction formula that is used for NAVD88, the heights are called Helmert Orthometric Heights. When G is computed using the International Formula for Normal Gravity, the heights are called Normal Orthometric Heights. When G is equal to normal gravity at 45° latitude, the heights are called Normal Dynamic Heights. It should be noted that dynamic heights are just geopotential numbers scaled by a constant, using normal gravity at 45° latitude equal to 980.6199 gals. Therefore, dynamic heights are also an estimate of hydraulic head. In other words, two points that have the same geopotential number will have the same dynamic height.

*c.* IGLD55 is a normal dynamic height system which used a computed value of gravity based on the International Formula for Normal Gravity. Today, there is sufficient observed gravity data available to estimate "true" geopotential differences instead of "normal" geopotential differences. The "true" geopotential differences, which were used in developing IGLD85 and NAVD88, will more accurately estimate hydraulic head.

## 4. Problems with NGVD29 and Why a New Datum Needed to be Established

*a.* Approximately 625,000 km of leveling have been added to the National Geodetic Reference System (NGRS) since the 1929 adjustment. Each new line has been adjusted to the network. The new leveling data uncovered some problems in NGVD29. Through the years, the agreement between the new leveling and the network BM elevations slowly grew worse. An investigation of NGVD29 general adjustment results indicates that large residuals were distributed in some areas of the country during that adjustment. For example, the accumulated 1929 adjustment correction along a 3000 km east-west leveling route from Crookston, Minnesota, to Seattle, Washington is a delta of 89 centimeters (cm).

*b.* Inconsistencies in NGVD29 have increased over the years. This increase is a function of factors such as:

(1) Many BMs were affected by unknown vertical movement due to earthquake activity, postglacial rebound, and ground subsidence.

(2) Numerous BMs were disturbed or destroyed by highway maintenance, building, and other construction.

(3) New leveling became more accurate because of better instruments, procedures, and improved computations. It was decided in 1977 that the high accuracy achieved by the new leveling was being lost when forced to fit the 1929 network, and plans were made to begin developing a new national vertical network.

*c.* These inconsistencies have not always been apparent to the user since NGS has periodically readjusted large portions of the NVCN and spread these large residuals over large areas. Eventually, however, there would be a large number of areas in which surveyors would not be able to check their work using NGVD29. NAVD88 is specifically designed to remove the inconsistencies and distortions such as those found in the NGVD29. NGS has held off incorporating approximately 40,000 km of newer leveling data for these reasons. These data were incorporated into the NAVD88.

## 5. Selection of the Adjustment Method for NAVD88

*a.* The FGCS created a Vertical Subcommittee in 1989 to study the impact of the NAVD88 on the programs of member agencies and to recommend a datum definition. Several different datum definitions for

NAVD88 were studied by the subcommittee and the three options below were selected for final consideration:

(1) Fix the elevation or mean sea level at a single point.

(2) Fix mean sea level at four tide gages located at the network corners.

(3) Fix the NGVD29 elevations at 18 existing, well scattered BMs.

*b.* Two options were considered for the establishment of the vertical datum: (1) tidal epoch or (2) a minimally constrained adjustment. The tidal epoch option required that the adjustment hold MSL fixed at all appropriate primary tide stations and use the latest available tidal epoch. This definition is actually the same as NGVD29, but used the latest data available. The other option used a minimally constrained adjustment holding local MSL fixed at one primary tide station and adjusting all leveling data to it. This second option would maintain the integrity of the leveling data but would also create the greatest deviation from the presently published data.

*c.* Research was done by NGS to determine which option would be the best choice. To assist in the NAVD88 datum definition decision, several adjustments were performed using different constraints. The results obtained from several trial adjustments indicate that no matter which datum definition scenario is chosen for NAVD88, including a minimally constrained adjustment, that changes in absolute heights of as much as 75 to 100 cm would exist between NGVD29 and NAVD88.

*d.* In addition to the NGS research, agencies and appropriate bodies were queried to determine which option would be their preference and to ask for recommendations. The FGCS and the American Congress on Surveying and Mapping (ACSM) established committees to investigate the impact of NAVD88 on their members' activities and the activities of others in the community. Members of these committees were requested to provide documentation on the affects that the readjustment would have on their user populations and to include specific examples describing the real impact of a new vertical datum on their products. USACE was included in the questionnaire survey. The ACSM report is included as a reference to this document.

*e.* As a preliminary measure, both committees drafted recommendations for NAVD88 and specified that NGS should:

(1) Perform minimally-constrained least squares adjustment of the data for NAVD88.

(2) Shift the datum vertically to minimize recompilation of National Mapping Products.

(3) Develop computer transformation software to convert between NGVD29 and NAVD88. ("VERTCON").

(4) Develop national and/or regional geoid models to ensure GPS height differences meet at least 2nd Order, Class II FGCS precise geodetic leveling standards for accuracy.

*f.* Results indicated that the tidal epoch option would minimize the magnitude of the changes from NGVD29 to NAVD88 and thus possibly allow direct comparison of present hydrographic survey elevations with the proposed new NAVD88 elevations. The smaller change between elevations would cause less confusion and concern over flow heights, and the like. Regardless of the datum definition selected, large differences would exist between the NAVD88 and the NGVD29 heights. It should be noted that the NAVD88 heights are better estimates of orthometric heights than the NGVD29 heights. Better estimates of orthometric heights will become more critical in the future as surveying techniques continues to become more sophisticated and more accurate. The improved accuracy of geoid height determinations using GPS data requires the best estimate of true orthometric heights. Many cartographers want heights on their maps based on the best estimate of true orthometric heights.

### 6. The NAVD88 Adjustment

*a.* The NAVD88 adjustment is the culmination of over ten years of work. This effort has included: establishing about 100,000 km of trunk line leveling to reinforce weak areas in the network; modernizing the vast amount of leveling observation and description data that has been collected for over a century; performing adjustments of sections of the network to verify the quality of the observation data; informing the public users of the network of the pending change and determining the impact on the nation's engineering activities. After the datum definition was selected to be a minimally constrained adjustment, the final task of this effort was to perform the least squares adjustment of the whole network.

*b.* The general adjustment of NAVD88 was completed in June 1991. The primary network consists of 200 loops containing 909 junction BMs. The network connects to 57 primary tidal stations which are part of the National Primary Tidal Network and 55 international water-level stations along the Great Lakes. In addition, 28 border connections were made to the Canadian vertical control network and 13 to the Mexican vertical control network. Third order BMs of other agencies (e.g., USACE) were not included in this adjustment. The 500,000 BMs established by the USGS were also not placed in computer readable form and therefore will not have NAVD88 heights. In addition, USACE commands have established thousands of BMs which will not have NAVD88 heights.

*c.* A particular concern for the developers of the NAVD88 was how to resolve the many issues associated with the National Mapping Program (NMP) of USGS and the National Map Accuracy Standard (NMAS). The NMP includes more than 83,000 different map products of which over 7 million copies are distributed annually. Almost all of these products contain elevation information as contours and spot elevations on maps or as elevation arrays in Digital Elevation Models. Changing these products, both graphical and digital, to the NAVD88 will be a massive and costly undertaking and will require a decade or more to complete.

*d.* The new leveling data have additional corrections applied for refraction and rod correction and are adjusted in geopotential units rather than the orthometric system used in the past. The datum definition is the most scientifically acceptable of all the definitions considered and is the most natural because it is based on an undisturbed representation of the Earth's gravity field. It is the most suitable for the geoid height computations needed for the reduction of GPS ellipsoidal heights. The main disadvantage is the differences with MSL on the west coast. At Seattle, a person standing on the zero elevation contour (NAVD88) will barely have their head above water at midtide.

*e.* Preliminary analysis indicates that the overall differences between orthometric heights referred to NAVD88 and to the NGVD29 range from approximately -40cm to +150cm. Most surveying applications should not be significantly affected because the changes in relative height between adjacent BMs in most geotechnically stable areas should be less than 1 cm. In many geotechnically stable areas, a single bias factor describing the difference between NGVD29 and NAVD88 can be estimated and used for most mapping applications. This was a significant consideration for assessing the impact on the National Mapping Products. The absolute height values will change much more, but this should not be the surveyor's biggest concern, since he/she should be concerned with ensuring that all height values of BMs are referenced to the same vertical datum. The overall differences between dynamic heights referred to the IGLD85 and to IGLD55 will range from approximately 1 to 40 cm.

## 7. Maintenance of Parallel Datums by NGS: NAVD88 and NGVD29

For a period of time, NGS will support both the NAVD88 and the NGVD29. Beyond the next 5-7 years, continued maintenance of NGVD29 will depend on user demands and budget constraints.

# SECTION II
# Impact of NAVD88 Conversion on Other Hydraulic Reference Datums

## 8. International Great Lakes Datum of 1955 (IGLD55)

*a.* IGLD55 is a datum common to the United States and Canada and is defined by international agreement. Before the establishment and adoption of the IGLD55, the differences in elevation between the lakes had been determined but had not been connected to sea level and lake level data published from the United States and Canada did not match for the same lakes and rivers. The IGLD55 was an international cooperative effort between the those two countries, the result of which was that the Great Lakes-St. Lawrence River system was then covered by a single uniform vertical control network. The IGLD55 is different and separate from the NGVD29.

*b.* IGLD55 is by definition a hydraulic (i.e., dynamic) datum. The reference zero for IGLD55 is based on mean water level surface at Father's Point (Pointe-au-Pere), Québec, Canada. Holding this point fixed determined the IGLD55 datum. A procedure termed a "water level transfer" has been used to establish a local vertical datum on each of the Great Lakes. Research has concluded that the water level transfer technique was concluded to be at least as accurate as First-Order, Class I geodetic leveling. The remaining lakes were incorporated using a combination of level lines and water level transfers. Adjusted elevations on the IGLD55 are referenced using the dynamic number system. The dynamic value of a benchmark (BM) is not a true linear elevation, but a serial number given to the level surface on which the mark lies. Dynamic elevations were adopted for the IGLD55 primarily because they provide a means by which the geopotential hydraulic head can be measured more accurately between two points.

*c.* The earth's crust experiences movements around the entire Great Lakes and St. Lawrence River area. Therefore, the vertical reference datum for this area must be vertically readjusted every 25 to 30 years. This crustal movement is called "isostatic rebound," which is the gradual rising of the earth rebounding from the weight of the glaciers during the last glacial age. When IGLD55 was created, it was known that readjustment would be necessary due to the effects of isostatic rebound. Crustal movement is not uniform across the Great Lakes basin and causes bench marks to shift not only with respect to each other, but also with respect to the initial reference point. Subsidence and other local effects can cause bench marks to shift as well.

## 9. International Great Lakes Datum of 1985 (IGLD85)

*a.* The Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data revised the IGLD55 datum and established IGLD85. This committee has input to the international management of the Great Lakes-St. Lawrence River system. Representatives from the U.S. and Canada are members on this committee. The efforts of the Coordinating Committee to revise IGLD55 and establish IGLD85 were coordinated with the efforts to establish the new common international vertical datum for the US, Canada and Mexico, NAVD88.

*b.* The IGLD85 is the current vertical control reference system in the Great Lakes Basin. The IGLD55 was the vertical control reference system for this area until the publication of the IGLD85 in January, 1992. Originally, an IGLD 80 had been planned, but the project was extended. The epoch that was actually used to determine the mean water level for the new datum was from 1983-1988 of which the mean year is 1985. The reference zero point for IGLD85 is located at benchmark #1250G, located at Rimouski, Québec. This benchmark has an IGLD85 elevation of 6.723 meters and IGLD55 elevation of 6.263 meters. IGLD85 increases the number and accuracy of benchmarks in the Great Lakes area. Corps districts were targeted to have converted over to IGLD85 by January of 1993. This cannot be practically done until NOAA publishes complete IGLD85 BM data for the area. IGLD85 data is available for the gages, but the spacing of the gages is not dense enough to support conversion of local project control.

*c.* Agencies in the U.S. and Canada will use IGLD85. The National Oceanic Service (NOS) and the Canadian Hydrographic Service (CHS) began reporting water levels referenced to IGLD85 upon its implementation in January, 1992. For a period of time, conversion factors for both IGLD55 and IGLD85 water level data will be provided by NOAA/NOS Great Lakes Section and CHS. The monthly water level bulletins published by USACE and CHS will reflect this information.

*d.* IGLD85 will not change water levels established for federal flood insurance programs in the US. These levels will be referred to NAVD88. Elevations common to both NAVD88 and IGLD85 are available from NOAA. Lake-level outflows also will not be affected by the datum change to IGLD85. As benchmark information becomes available, navigation, construction, and other improvement work on the Great Lakes should be referred to IGLD85. Either datum is acceptable until the benchmark data is available for the respective USACE District or project area. Drawings shall include a note for the vertical IGLD datum in use to avoid blunders. USACE permit applications will still be referenced to the Ordinary High Water Mark (OHWM) as defined under Section 10 of the Rivers and Harbors Act. As benchmark information becomes available, new applications should reference IGLD85.

## 10. NAVD88 and IGLD85

*a.* The specific needs of the Great Lakes system were taken into account while the decision were being made about how NAVD88 was to be established. Analyses of data in the Great Lakes Basin was used to determine the effects of the datum constraint, magnitudes of height changes from the IGLD55, deficiencies in the network design, selection of water-level station pairs to be used to generate zero geopotential difference observations, and additional releveling requirements. This coordination provided a check on the accuracy of the work and established a conversion between the IGLD85 and NAVD88.

*b.* Elevations referenced to NGVD29 are unacceptable for use in resolving the involved problems of the Great Lakes System. The reference zero for NGVD29 is not located within the Great Lakes system and orthometric elevations are not sufficient for use with large bodies of water such as the Great Lakes. The dynamics of large bodies of water are not modelled well by considering them as single equipotential surfaces. Other forces such as gravity must be considered. For example, water level measurements obtained at both ends of the Lake and connected to the NGVD29 would show some magnitude of a permanently northerly slope.

*c.* The general adjustment of the NAVD88 and IGLD85 is one and the same. A minimum constraint adjustment of Canadian-Mexican-U.S. leveling observations was performed holding fixed the height of the primary tidal BM, referred to the new IGLD85 local mean sea level height value, at Father's Point/Rimouski, Québec, Canada. This constraint satisfies the requirements of shifting the datum vertically to minimize the impact of NAVD88 on USGS mapping products, as well as provides the datum point desired by the IGLD Coordinating Committee for IGLD85. The only difference between IGLD85 and NAVD88 is that IGLD85 BM values are given in dynamic height units and NAVD88 values are given in Helmert orthometric height units. The geopotential numbers of BMs are the same in both systems.

*d.* Geopotential numbers from the general adjustment of NAVD88 were used to compute IGLD85 dynamic heights. They will provide the best estimate of hydraulic head. If secondary gage data are placed in computer readable form, they will also be incorporated into NAVD88 and IGLD85. NGS will publish NAVD88 heights and provide, upon special request, geopotential numbers for all BMs included in NAVD88.

*e.* The use of GPS data and a high-resolution geoid model to estimate accurate GPS-derived orthometric heights will be a continuing part of the implementation of NAVD88 and IGLD85. It is important that users initiate a project to convert their products to NAVD88 and IGLD85. The conversion process is not a difficult task, but will require time and resources. Other local reference planes have been established by local jurisdictions and these can be referenced to either IGLD85 or NAVD88.

## 11. 1974 Low Water Reference Plane (LWRP)

*a.* On the Mississippi River between the mouths of the Missouri and the Ohio Rivers (the Middle Mississippi River), depths and improvements are referenced to a LWRP. No specific LWRP year is used for the Middle Mississippi north of Cairo, IL. Below Cairo, IL, depths and improvements along the Lower Mississippi River are referenced to the 1974 LWRP. This is also a hydraulic reference plane, established from long term observations of the river's stage, discharge rates, and flow duration periods. The low water profile was developed about the 97-percent flow duration line. The elevation of the 1974 LWRP drops gradually throughout the course of the Mississippi, however, some anomalies in the profile are present in places (particularly in areas containing rock bottoms or groins/weirs). The gradient is approximately 0.5 feet per river mile. The ever-changing river bottom will influence the 1974 LWRP. Changes in the stage-discharge relationship will influence the theoretical flow line for the 1974 LWRP.

*b.* Construction and improvements along the lower river are performed relative to the 1974 LWRP at a particular point. Differences in 1974 LWRP elevations between successive points along the river are determined from simultaneous staff readings and are referenced to benchmarks along the bank. The 1974 LWRP slope gradients between any two points must be corrected by linear interpolation of the profile. Thus, over a typical 1-mile section of river with a 0.5-foot gradient, each 1000-foot C/C river cross section will have a different 1974 LWRP correction, each dropping successively at approximately 0.1-foot increments.

*c.* Where practicable and feasible, NAVD88 should be used as the common reference plane from which 1974 LWRP elevations are measured. The relationship of all project datums to both NGVD29 and NAVD88 should be clearly noted on all drawings, charts, maps, and elevation data files. All initial surveys should be referenced to both NAVD88 and NGVD29. If this is not feasible, then NGVD29 should be used as the common reference plane from which 1974 LWRP elevations are measured until the move to NAVD88 can be accomplished. Differences between the 1974 LWRP and NGVD29 are published for the reference benchmarks used to control surveys and construction activities. In some districts, surveys are performed directly on NGVD29 without regard to the 1974 LWRP profile (i.e., elevations above NGVD29 are plotted rather than depths below 1974 LWRP). The 1974 LWRP depths are then contoured from the plotted NGVD29 elevations, with the 1974 LWRP profile gradients applied during the contouring process. If a survey is conducted over a given reach of the river, the 1974 LWRP-NAVD88 and/or the 1974 LWRP-NGVD29 conversion must be interpolated based on the slope profile over that reach.

*d.* Controlled portions of the Upper Mississippi are referred to pool levels between the controlling structures. Although a variety of reference datums are used on other controlled river systems or impoundment reservoirs, most are hydraulically based and relate to some statistical pool level (e.g., "normal pool level," "flat pool level," "minimum regulated pool level ", etc.).

*e.* On the Mississippi River above Melvin Price Locks and Dam at Alton, IL, to Lock and Dam No. 22 at Saverton, MO, the reference used is related to the minimum regulated pool elevation. These pools are regulated referenced to a "hinge point". The pools are drawn down when the river's flow will provide adequate navigation depths naturally. When the flows are reduced to low volumes, the pools are reestablished and are essentially level. The depths and improvements along this reach of the Mississippi River are referenced to the "minimum regulated pool" elevations.

*f.* On the Mississippi River above Lock and Dam No. 22 at Saverton, MO, to St. Paul, MN, a "flat pool level" reference is used, and soundings are shown as "depth below flat pool". The flat pool is the authorized elevation of the navigation project and can be referenced to any number of local datums. Most commonly, this level is referenced to the mean sea level (MSL) datum of 1912, the general adjustment which preceded 1929. Conversions between MSL 1912 and NGVD29 are available. The Illinois Waterway pool elevations are referred to NGVD29, however, relationships to numerous other datums are also made.

*g.* Vertical clearances (bridges, transmission lines, etc.) are usually measured relative to high and low waters of record, or relative to full pool elevations. Shore lines shown on river drawings and navigation maps may be referenced to a low water datum (i.e., 1974 LWRP). On the Mississippi River above Lock and Dam No. 22 at Saverton, MO, the plotted shore line is referenced to full pool stage at dams with discharges equaled or exceeded 90 percent of the time. Given the variety of reference levels, special care must be taken to properly identify the nature and source of all vertical reference datums used on a project. The datum notes should include and clearly depict the relationship to NAVD88.

## SECTION III
## Impact of NAVD88 Conversion on U.S. Geological Survey and Federal Emergency Management Agency Programs

### 12. NAVD88 and the National Mapping Program (NMP)

*a.* The NMP of the U.S. Geological Survey (USGS) includes more than 83,000 different map products. Some 55,000 of these are in the 7.5-minute, 1:24,000-scale, primary quadrangle map series (7.5-minute quads). These maps are widely used by Corps planners. Since the 7.5-minute quad series is the largest scale in the NMP and contains the greatest detail and elevation accuracy, it will be significantly affected by the vertical datum change.

*b.* The contour intervals of the 7.5-minute map series are selected to best express the topography of the area. With a few exceptions, the contour intervals range from 5 feet for very flat country to 80 feet for rugged mountainous terrain. In between these limits are 10-, 20-, and 40-foot contour intervals. A few maps in recent years have been compiled with metric value contours. The USGS production processes were designed to produce maps that meet the requirements of the National Map Accuracy Standards (NMAS). This standard requires that the error in 90% of the test points be less than one-half contour interval. Field survey methods are generally used to test the maps, and the elevation on the map is determined by interpolation between contours.

*c.* Other forms of vertical information shown on the USGS 7.5-minute maps are BMs and useful elevations, which are indicated by a cross symbol with the elevation given to the nearest foot. These elevations are established by geodetic leveling of third-order accuracy or better. Spot elevations are measured by field or photogrammetric methods are readily identifiable features, eg: natural lakes, definite tops and saddles, fence corners, or road intersections. These elevations are usually placed at a density of about one-per-square mile and are considered to be accurate to within three-tenths of the contour interval.

*d.* Digital files of topographic information will also be affected by a change in the vertical datum. A Digital Elevation Model (DEM) consists of a sampled array of elevations for ground positions that are usually at regularly spaced intervals. For the 7.5-minute DEM, the horizontal framework is the Universal Transverse Mercator (UTM) system and the spacing is 30 meters. The 1-degree DEM horizontal coordinate system is based on the latitude and longitude positions of the World Geodetic System of 1972 (WGS 72) datum and the spacing is 3 arc-seconds. Another form of the digital topographic data that will be affected by the datum conversion is the hypsography category Digital Line Graphs (DLG).

*e.* In support of the production of the USGS topographic maps, a 3rd order level network was established that resulted in few places being more than 5 miles from basic vertical control. These lines were usually established along farm roads, railroads, desert track roads, and mountain trails (less dense in mountain areas). USGS field surveyors have established nearly 500,000 BMs. Most of this work is on NGVD29.

*f.* Changing the above NMP products, both graphic and digital, to the NAVD88 will be a massive and costly undertaking and will require a decade or more to complete.

(1) In areas where the datum change is very small compared with the contour interval, advantage can be taken of the tolerance in the NMAS (i.e., 90% of the test point errors are less than ½ of the contour interval). If the datum change is only 1/10th of the contour interval, then the existing contours will still meet NMAS and will not require recompilation. The labeled elevations for BMs and spot elevations will need to be changed. This type of conversion is a low-cost approach but might be useful to extend the life of an otherwise sound map series. This is not a technically correct solution because a small bias is being introduced. Special care must be taken to insure that the contouring is in agreement with changed labeled elevations.

(2) Recompiling the contours and spot elevations on a 7.5-minute quad map is the most geometrically correct method of fitting the new vertical datum; however, this is an expensive approach. Therefore, total recompilation and recontouring due to an out-of-date datum is not considered to be cost-effective. However, some other factors may justify recompilation:

- Change to metric contours
- Terrain changes because of subsidence or other

causes
- Inaccurate existing contours or inappropriate contour interval

*g.* Adjusting the USGS 3rd-order leveling network to the NAVD88 is a different challenge, because high accuracy is needed to maintain its usefulness as geodetic data. This level of accuracy can only be provided by a least squares adjustment of the old observations to the new NAVD88 primary network elevations.

*h.* The selected NAVD88 datum definition best fits the needs of the NMP. The important characteristics are:

- Small elevation changes for the eastern half of the USA where the 7.5 map contour intervals are the smallest and large changes for the western half where contour intervals are the largest.

- The isograms representing these changes are smoother and show less irregularities.

Both of these are important if the map patching conversion techniques is to be used. The requirements are that the shift values be small compared with the contour interval and the gradient in the datum change be minimal so that a single change value can be applied over an entire 7.5-minute map with little noticeable error. A vertical shift (bias) in the defining elevation is desirable to expand the favorable interval/elevation change area over the entire U.S.

## 13. National Flood Insurance Program (NFIP) Transition to NAVD88

*a.* The NFIP is a federal program that provides identification of flood hazard areas on a community basis and includes availability of insurance against flood damages. When a community joins the NFIP, it agrees to adopt minimum Federal floodplain management criteria enforced by local regulations. The major product of the NFIP is the Flood Insurance Study (FIS) and accompanying Flood Insurance Rate Map (FIRM), which describes a community's floodplains and regulatory floodways, as well as computed flood profiles. FEMA prepares an FIS for severely flood prone communities, that identifies 100-year base flood elevations (BFEs) and flood hazard areas. Nearly all flood maps for these areas are referenced to the NGVD29. Conversion to NAVD88 will require the education of map users as well as map producers. New FISs will be based on NAVD88. Existing studies and maps will be converted when substantive revisions occur to redefine flood hazards.

*b.* The dual mission of the NFIP through the Federal Insurance Administration (FIA) is to reduce future flood losses as well as provide insurance coverage to offset deficit producing disaster assistance payments. To provide the floodplain management information to the communities, FEMA provides flood hazard mapping of major flooding sources within a community, usually based on the 100 year BFEs.

*c.* FEMA will be converting its products the NAVD88 in a gradual process primarily as FEMA's FISs and FIRMs are republished. Currently, the vast majority of FEMA products for the NFIP are referred to NGVD29. All FEMA studies contracted for FY93 and beyond will require the use of NAVD88 as vertical control. Since October 1992, all requests for map change actions received required the inclusion of NAVD88 data. The NFIP will transition to NAVD88 on a project basis or as other reasons for revision indicate.

## 14. Effects of NAVD88 on FIRMs and Communities

*a.* The base 100-year BFEs and Elevation Reference Marks (ERMs) will be converted to NAVD88. Use of the current datum will be acceptable until the change is made of the FIRM. After that time, all flood insurance policy sales and renewals will be based on elevations referenced to NAVD88. Determination of locations of structures and proposed projects with respect to special flood hazard areas (SFHAs) will be based upon elevations referenced to NAVD88. The datum listed as the reference datum on the applicable FIRM panel should be used for Elevation Certificate completion. This is FEMA policy for all NFIP communities since the NAVD88 is defined over all these regions. For Hawaii, the Pacific Trust Territories, the Commonwealth of Puerto Rico and the US Virgin Islands, their datums will be adjusted based upon releveling work done in those areas and their 1960-78 tidal epoch. Their local datums will be designated as NAVD88 and will be defined by their current local MSL determinations.

*b.* The conversion of the vertical reference datum from NGVD29 to NAVD88 will take place over time and documentation should be carefully maintained to reflect which vertical reference datum was used. If a FIS is completed with ERMs referenced to NAVD88, the conversion method and results shall be part of the deliverable items with that FIS. The FEMA Project Officer should be consulted to decide if NAVD88 must be used or not, prior to commencement of any work for that FIS.

*c.* No requirement is made by FEMA on local communities to relevel their local vertical control networks for NFIP purposes. If, however, the community's current vertical control system is referenced to an NGS bench mark(s) that is included in the new data available from NGS, then appropriate conversion can be made. Questions regarding the mechanics of shifting to NAVD88 may be addressed to the appropriate FEMA Regional Offices.

*d.* A very important potential problem is caused by mixing datums. If a consistent datum is used for determining Base 100-year BFEs and lowest floor elevation, actuarial rating and building requirements would be correctly determined. If mixed datums are used, significant problems arise. For example, if the 1-foot NAVD88 BFE is used mixed with the 2-foot NGVD29 lowest floor elevation, an error of 2 feet (not in the NFIP's favor) would occur. There are roughly 22 million people living in the nation's floodplains. Proposed elevations above the BFE are sometimes minimal for economic considerations, so up-to-date and properly referenced elevation data are a must. Correct referencing of those floodplains to the nation's vertical datum must be accomplished as soon as it is administratively and financially possible to do so.

## 15. Map Revision Requests to FEMA

*a.* As the NFIP moves further into the maintenance stage of the mapping program, the major action with respect to mapping of flood hazards will be the review and processing of requests for revisions to the currently effective FISs and FIRMs. The decision of whether to convert to NAVD88 as the reference datum for a revision action must be made on a case by case basis. All map revision requests should contain documentation of vertical control used and those requests to FEMA after 1 October 1992 must include vertical control data referenced to NAVD88. The decision regarding the published reference for the map revision will be made by the FEMA Project Officer for the applicable region.

*b.* Map revision requests shall include either NGS BM data or the method and computations used to tie to NGS BMs. If NGS BM data is unavailable, documentation to that effect must be submitted with the map revision request. If a computer program was used, the name of the program should be included along with where an exact copy of that program can be obtained. The leveling field notes should also be included. All surveying data must be certified by a licensed Land Surveyor or registered Professional Engineer. For all map revisions, the datum referenced on the current FIRM shall be used unless otherwise directed by the Project Officer. When the current map datum is used, a conversion factor to allow comparison to NAVD88 elevation should be included.

## 16. Impact of NAVD88 Change on Flooding Sources

*a. Riverine and Lacustrine Flooding.* For most areas affected by this type of flooding, the changes from NGVD29 to NAVD88 will be adequately addressed by a shift factor for areas of USGS 7.5-minute quadrangle series topographic maps. In larger areas than that, such as county wide studies involving significant stream or river reaches, additional considerations are necessary.

*b. Coastal Flooding.* In areas affected by coastal flooding, additional care must be taken to avoid confusion with local MSL data that are used in addition to NGVD29 data. In many areas, these are assumed to be the same, while in other areas differences may exist based upon the latest tidal observations. NGS has included in its published data the new reference elevations for tidal stations previously taken as 0.0000 foot on NGVD29. All vertical data must clearly reflect what basis of vertical control was used. For example, if mean low water datum was used, conversion to NAVD88, or at a minimum NGVD29, must be provided and sealed by a certified land surveyor.

*c. Other Influences.* Areas that have experienced crustal motion or land subsidence since the publication of the vertical control data for that area, must be referenced to at least one BM known to be stable. Documentation from a certified land surveyor or by the agency that recently releveled the BM must be included with any data submitted to FEMA. NGS will be publishing special reports for these areas as part of its ongoing long term task.

(1) For areas that experience uniform change over a given range, and where datum difference can be expressed as a bias factor for specific geographic areas, little

if any distortion will occur in the hydrologic and hydraulic parameters that influence the definition of a given floodplain. In these instances, FEMA will be concerned with assuring that the proper conversion of ground and hydraulic elevations takes place.

(2) In instances where non-uniform elevation differences are indicated, an investigation of the potential effect on hydraulic behavior will be required. Usually, unless the change in flood elevation or depth is greater than 0.5 foot or in some cases 1.0 foot, no republication of the flood elevations is dictated. Indications of potential changes of 1.0 foot or more will probably place the stream or community on the priority list for a contracted restudy to establish the exact effect of the changes.

## 17. FEMA Policy for Map Conversion: Affect on NFIP Products

FEMA datum conversion activities called for all FY93 FIS's to be referenced to NAVD88 and that this action be confirmed by the contractor with the Project Officer prior to the beginning of survey work. The study contractor is responsible for assuring that proper reference to NAVD88 is made.

## 18. NAVD88 Requirements for Flood Insurance Studies

*a. Type 15 Studies.* For initial studies, NAVD88 shall be required. Exceptions must be approved by the Project Officer prior to the start of survey work.

*b. Type 19 Studies and Limited Map Maintenance Program Studies.* Use of NAVD88 shall be the decision of the Project Officer. If NGVD29 is used, then a conversion factor to NAVD88 should be included with the study material.

*c.* The use of NAVD88 for these studies will be determined by the extent of the changes that will occur to the community's FIRM when revised. For communities whose FIRM is larger than 1 panel and revision of other panels is unlikely with the restudy, the use of NGVD29 may be continued, but a note explaining the conversion to NAVD88 should be included in the "NOTES" in the map border of the panel being revised.

## SECTION IV
## Corps of Engineers Transition Plan to NAVD88

### 19. General

A change in vertical datum will affect most USACE engineering, construction, planning, and surveying activities. The cost of conversion could be substantial at the onset. There is a potential for errors in conversions inadvertently occurring. The effects of the vertical datum change can be minimized if the change is gradually applied over time; being applied to future projects and efforts, rather than concentrated on changing already published products. In order to insure an orderly and timely transition to NAVD88 is achieved for the appropriate products, the following general guidelines in this section should be followed.

*a. Conversion Criteria.* Maps, engineering site drawings, documents and associated spatial data products containing elevation data may require conversion to NAVD88. Specific requirements for conversion will, in large part, be based on local usage -- that of the local sponsor, installation, etc. Where applicable and appropriate, this conversion should be recommended to local interests.

*b. Newly Authorized Construction Projects.* Generally, initial surveys of newly authorized projects should be referenced to NAVD88. In addition to design/construction, this would include wide-area master plan mapping work. The project control should be referenced to NAVD88 using conventional or GPS surveying techniques. All planning and design activities should be based upon NAVD88. All maps and site drawings shall contain datum notes as described below. If the sponsor/installation requires the use of NGVD29 or some other local vertical reference datum for continuity, the relationship between NGVD29 and NAVD88 shall be clearly noted on all maps, engineering site drawings, documents and associated products.

*c. Active Projects.* On active projects where maps, site drawings, or elevation data are provided to non-USACE users, the conversion to NAVD88 should be performed. This conversion to NAVD88 may be performed the next time the project is surveyed or when the maps/site drawings are updated for other reasons. Civil works projects may be converted to NAVD88 during the next maintenance or repair cycle in the same manner as for newly initiated civil works projects. However, if resources are not available for this level of effort, either re-draw the maps or drawings and add the necessary datum note. Plans should be made for the full conversion during a later maintenance or repair cycle when resources can be made available. MCA, OMA, AFH, OMAR, MCAF, OMAF and master planning projects should remain on NGVD29 or the local vertical datum until a thoroughly coordinated effort can be arranged with the MACOM DCSENGR and installation DEH, or AFRCE and BCE. An entire installation's control network should be transformed simultaneously to avoid different datums on the same installation. MACOMs should be encouraged to convert to NAVD88. However, the respective MACOMs are responsible for this decision.

*d. Inactive Projects.* For inactive projects or active projects where maps, site drawings or elevation data are not normally provided to non-USACE users, conversion to NAVD88 is optional.

*e. Work for Others.* Projects for other agencies will remain on NGVD29 or the current local vertical datum until a thoroughly coordinated effort can be arranged with the sponsoring agency. Other agencies should be encouraged to convert their projects to NAVD88, although the decision to convert rests with the sponsoring agency. However, surveys, maps and drawings should have the datum note described below added before distribution to non-USACE users. If sponsoring agencies do not indicate a preference for new projects, NAVD88 should be used.

*f. Miscellaneous Projects.* Other projects referenced to strictly local datum, such as structural deformation, beach nourishment, submerged offshore disposal areas, historical preservation projects, etc., need not necessarily be converted to NAVD88. However, it is recommended that surveys, maps and drawings have a clear datum reference note added before distribution to non-USACE users.

### 20. Datum Reference Note

Whenever maps, site drawings or spatial elevation data are provided to non-USACE users, they should contain a datum note that provides, at minimum, the following information:

The elevations shown are referenced to the [NGVD29] [NAVD88] and are in [feet] [meters]. Differences between NGVD29 and NAVD88 at the center of the project sheet/data set are shown on the diagram below. Datum conversion was performed using the [program VERTCON] [direct leveling connections with published NGS benchmarks] [other]. Metric conversions are based on [US Survey Foot = 1200/3937 meters] [International Survey Foot = 30.48/100 meters].

## 21. Technical Advantages in Converting to NAVD88

There are several compelling reasons that make it advantageous for USACE commands to convert to NAVD88. These include:

- Differential leveling surveys between bench marks will often close better.
- NAVD88 will provide a better reference to estimate GPS-derived orthometric heights.
- IGLD85 will provide a better reference to estimate heights of water-level surfaces on the Great Lakes.
- Data and adjusted height values will be readily available and accessible in convenient form from NGS's Integrated Data Base.
- Federal surveying and mapping agencies will stop publishing on NGVD29 and IGLD55, and will publish only on NAVD88 and IGLD85.
- Surveys performed for the Federal government will require use of NAVD88.
- NAVD88 is recommended by ACSM and FGCS.

## 22. Levels of Effort

For map and site plan drawings, including digital variations thereof, the conversion process entails one of two levels of effort: (1) conversion of all elevations to NAVD88 and re-drawing the map, or (2) simply adding a datum note based on an approximate VERTCON conversion.

## 23. Real Estate Implications

*a.* Surveys, maps and plats prepared in support of civil works and military real estate activities should conform as much as possible with state requirements. Many states are expected to adopt NAVD88 (by statute) as an official vertical reference datum. This likewise will entail a transition to NAVD88 in those states. State and local authorities should therefore be contacted to ascertain their current policies.

*b.* Note that several states have adopted the International Foot for their standard conversion from meters to feet. However, recent action by the FGCS to affirm continued use of the U.S. Survey Foot for Federal surveying activities could lead to a reversal of some state policies.

*c.* In order to avoid dual elevations on USACE survey control points which have multiple uses, it is recommended that published elevations be based on the U.S. Survey Foot. In states where the International Foot is the only accepted standard for boundary and property surveys, conversion of these elevations to NAVD88 should be based on the International Foot while the control remains based on the U.S. Survey Foot.

# SECTION V
# VERTCON 1.0

## 24. General Description of VERTCON

VERTCON is a program developed by the NGS that converts elevation data from NGVD29 to NAVD88. VERTCON uses a simplified transformation of bench-mark (BM) heights using a modeled shift for a given area and is, in general, only sufficiently accurate to meet small-scale mapping requirements. VERTCON should not be used for converting benchmark elevations used for site plan design or construction applications. Users can simply input the latitude and longitude for a point and the vertical datum shift between NGVD29 and NAVD88 is output. Data may be input either point-to-point by hand or by batch file. Three batch file formats are supported:

• Free File Format Type 1
• Free File Format Type 2
• NGS Internal BM Format Type 3

A "help" menu in the program gives information and examples of the file formats. Example inputs and outputs for the first two batch file types and a hand input type are included in the following pages. In the existing release, survey points must be input in North American Datum of 1983 (NAD 83) horizontal coordinates. Future releases will convert inputs to NAD 83. This release works on IBM compatible PCs running DOS. VERTCON is command line driven and should be fairly easy to use for anyone with basic computer skills. Batch files are explained in the help menu within the program and can be created through the use of a standard text editor. The command line interface is very basic, but functional.

## 25. USACE Program CORPSCON

VERTCON was released by NGS in early 1993. During the later part of FY94, VERTCON will be incorporated into USACE program CORPSCON, which is currently used for horizontal datum conversions between the North American Datum of 1927 (NAD 27) and NAD 83. CORPSCON can use either geographic, State Plane or UTM coordinates as input/output. Until the revised version of CORPSCON is available, the current version can be used in combination with VERTCON to perform vertical datum conversions with State Plane or UTM inputs.

## 26. VERTCON Installation and Operation Details

Program VERTCON consists of the following files:

VERTCON.EXE - Executable program file
VERTCON.DIR -Directory of VERTCON data base (non-readable, i.e., binary, file)
VERTCON.COF -Coefficients of VERTCON data base (non-readable, i.e., binary, file)
README.TXT -User's instruction file

*a. VERTCON Installation.*

(1) Make sure the original floppy disk is write-protected.

(2) Make a subdirectory on hard disk; for example: "mkdir NGVDCONV" (VERTCON will also run from the floppy disk)

(3) Go into a subdirectory; for example: "cd NGVDCONV"

(4) Copy the floppy disk into the subdirectory; for example: "copy A:*.* *.* /v"

(5) Put the original floppy in a safe place.

*b. VERTCON Execution.* Type "VERTCON" and follow the prompts.

*c. VERTCON Termination.* VERTCON computa-tions can be stopped at any time by the Control-C (i.e., <ctrl-c>) key combination, but interactive processing can be terminated by entering 0. (i.e., zero WITH DECIMAL POINT)

## 27. VERTCON Modeling Procedure

The modeled conversion of NGVD29 normal orthometric heights to NAVD88 Helmert orthometric heights can be accomplished by using the VERTCON software. This conversion is sufficiently accurate for many small-scale mapping purposes. The software and two files of modeling coefficients (data base) for the conterminous United States (CONUS) are provided on the disk.

VERTCON returns the orthometric height difference between NAVD88 and NGVD29 at the geodetic position specified by the user. The root-mean-square (RMS) error of the actual NGVD29/NAVD88 height differences versus the computed height differences from the model for the data points used to create the model is ± 1 cm; the estimated maximum error is ± 2.5 cm. Depending on network design and terrain relief, larger differences (e.g., 5 to 50 cm) may occur the further a bench mark is located from the control points used to establish the model coefficients. For this reason, VERTCON should only be used for approximate conversions where these potential errors are not critical. If feasible, future versions of VERTCON will contain estimates of uncertainty on a region-by-region basis.

## 28. VERTCON Data Input Procedures

The user can key in latitude and longitude on a point-by-point basis or can create an input file using a text editor. Several file formats are provided, including the internal bench mark file record format of the Vertical Network Branch, NGS. These formats are detailed in a "Help" menu option which appears when the input filename is specified. Most horizontal positions of the bench marks used to generate VERTCON were scaled from USGS topographic maps. The estimated uncertainty of the scaled positions is far greater than the differences between NAD 27 and NAD 83. Therefore, the horizontal geodetic datum to which the latitude and longitude are referenced (either NAD 27 or NAD 83) should not adversely affect the computed height difference since the height differences change very little with slight changes in horizontal position, i.e., less than 100 meters.

## 29. VERTCON Data Output

VERTCON Results are collected into an output file. The default name of this file is "VERTCON.OUT", but the user can choose any other legal filename. (Do not use misleading extensions such as *.EXE, *.DIR, *.COF, or *.BAT). The format of the output file is linked to the format of the input file to maintain consistency.

## 30. Derived NAVD88 Heights from NGVD29 Heights

The modeled NAVD88 - NGVD29 height differences convert from NGVD29 normal orthometric heights to NAVD88 Helmert orthometric heights. This value is ADDED ALGEBRAICALLY to NGVD29 normal orthometric heights to obtain NAVD88 Helmert orthometric heights. If a NGVD29 height is desired when a NAVD88 height is given, SUBTRACT the value ALGEBRAICALLY from the NAVD88 height.

## 31. VERTCON Models for CONUS

*a.* Interconnected local VERTCON models were computed in October 1992 using more than 300,500 NAVD88 - NGVD29 orthometric height differences. The aggregate of these local models, defined for 144 Helmert blocks, comprise the total VERTCON model for CONUS. The benefit of developing this mosaic of local models is that any error found locally, such as gross errors and/or an inconsistent leveling network, can be corrected promptly and the data base "repaired" swiftly without affecting any other area.

*b.* The method of computation is based on Professor Rolland L. Hardy's multiquadric method for data modeling and prediction. Accordingly, a set of coefficients of radial basis functions are determined at "optimally" selected data points in a two-dimensional space. These coefficients define an irregular surface which matches the selected data exactly, in this case the NAVD88 - NGVD29 height differences, and approximate the data at varying error levels at other points.

*c.* It is desirable for datum conversion efficiency purposes to model the data field with a minimal set of surface coefficients, while keeping the deviation of the surface at non-selected data points within predefined bounds. This was achieved by an iterative process in which, after a small initial set of data points was modeled, additional data points were gradually added to the model at the locations of largest deviations between model surface and data. This approach provided a minimal set of model coefficients, while maintaining predefined error bounds.

*d.* The data base and VERTCON software are operational on standard disc operating system (DOS) controlled (IBM-compatible) personal computers (PC). However, the executable code and (binary) data base may not be transferable to other systems. In the near future two additional modules will be provided:

(1) CONVASCI -- will extract and store the local models in an ASCII file for transfer to other systems

(2) CONVBIN -- will restore the ASCII file into a two-file binary data base on the new system. The

recompiled VERTCON software can then operate on this data base.

## 32. Future VERTCON Modifications

A continuing development effort is underway to improve VERTCON results. NGVD29 normal orthometric heights are being analyzed for localized monument and/or crustal motion effects, for inconsistent adjustments, and other effects. Computed height differences which are significantly influenced by such effects will be flagged and rated for reliability on the output.

# Appendix 35
# NGS Data Sheet for IPET GPS Control

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```
SURVEY CONTROL DATA

PROJECT=[GPS2212] IPET HURRICANE KATRINA

Version = APRIL 13, 2006
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH0937 ***********************************************************************
 BH0937  HT_MOD      -  This is a Louisiana Height Modernization Survey Station.
 BH0937  CBN         -  This is a Cooperative Base Network Control Station.
 BH0937  TIDAL BM    -  This is a Tidal Bench Mark.
 BH0937  DESIGNATION -  874 7437 TIDAL 1
 BH0937  PID         -  BH0937
 BH0937  STATE/COUNTY-  MS/HANCOCK
 BH0937  USGS QUAD   -  BAY ST LOUIS (1993)
 BH0937
 BH0937                        *CURRENT SURVEY CONTROL
 BH0937  ___________________________________________________________________
 BH0937* NAD 83(1993)-  30 19 26.02790(N)    089 19 38.73164(W)     ADJUSTED
 BH0937* NAVD 88     -          1.60 **(meters)       5.2  **(feet)  GPS OBS(2004.65)
 BH0937  **This station is located in a subsidence area (see below).
 BH0937  ___________________________________________________________________
 BH0937  X           -      64,680.695 (meters)                     COMP
 BH0937  Y           -  -5,509,813.989 (meters)                     COMP
 BH0937  Z           -   3,201,404.897 (meters)                     COMP
 BH0937  LAPLACE CORR-           -1.90  (seconds)                   DEFLEC99
 BH0937  ELLIP HEIGHT-          -25.96  (meters)         (04/11/06) GPS OBS
 BH0937  GEOID HEIGHT-          -27.57  (meters)                    GEOID03
 BH0937  DYNAMIC HT  -            1.59  (meters)       5.2   (feet)  COMP
 BH0937  MODELED GRAV-     979,323.8   (mgal)                       NAVD 88
 BH0937
 BH0937  HORZ ORDER  -  B
 BH0937  VERT ORDER  -  FIRST     CLASS I (See Below)
 BH0937  ELLP ORDER  -  FOURTH    CLASS II
 BH0937
 BH0937.The horizontal coordinates were established by GPS observations
 BH0937.and adjusted by the National Geodetic Survey in February 2002..
 BH0937
 BH0937 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 BH0937 ** and geoid heights are valid at the date of observation. These heights
 BH0937 ** must always be validated when used as control.
 BH0937 ** The orthometric height was determined by GPS observations using
 BH0937 ** precise GPS observation and processing techniques and a new
 BH0937 ** realization of GEOID03. It supersedes the leveled height previously
 BH0937 ** determined for this station.
```

```
BH0937 ** The geoid height was determined by a new realization of GEOID03 for the
BH0937 ** epoch indicated which incorporates improved geoid heights for the
BH0937 ** Southern Louisiana Subsidence area.
BH0937 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH0937.The orthometric height was determined by GPS observations and a
BH0937.high-resolution geoid model using precise GPS observation and
BH0937.processing techniques. It supersedes the leveled height previously
BH0937.determined for this station.
BH0937.The vertical order pertains to the first NAVD 88 superseded value.
BH0937
BH0937.This Tidal Bench Mark is designated as VM 798
BH0937.by the Center for Operational Oceanographic Products and Services.
BH0937
BH0937.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH0937
BH0937.The Laplace correction was computed from DEFLEC99 derived deflections.
BH0937
BH0937.The ellipsoidal height was determined by GPS observations
BH0937.and is referenced to NAD 83.
BH0937
BH0937.The geoid height was determined by GEOID03.
BH0937
BH0937.The dynamic height is computed by dividing the NAVD 88
BH0937.geopotential number by the normal gravity value computed on the
BH0937.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH0937.degrees latitude (g = 980.6199 gals.).
BH0937
BH0937.The modeled gravity was interpolated from observed gravity values.
BH0937
BH0937;                    North         East     Units Scale Factor Converg.
BH0937;SPC MS E     -    91,428.616   252,484.548   MT  0.99997784   -0 14 58.1
BH0937;SPC MS E     -   299,962.05    828,359.72   sFT  0.99997784   -0 14 58.1
BH0937;UTM  16      - 3,356,972.099   276,227.351   MT  1.00021780   -1 10 32.1
BH0937
BH0937!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH0937!SPC MS E     -   1.00000408  x   0.99997784  =   0.99998192
BH0937!UTM  16      -   1.00000408  x   1.00021780  =   1.00022188

BH0937
BH0937                         SUPERSEDED SURVEY CONTROL
BH0937
BH0937  ELLIP H (04/15/02)  -25.92   (m)                        GP(       ) 4 2
BH0937  ELLIP H (02/15/02)  -25.92   (m)                        GP(       ) 4 1
BH0937  NAVD 88 (06/15/91)    1.652  (m)            5.42   (f) ADJUSTED    1 1
BH0937  NGVD 29 (??/??/??)    1.608  (m)            5.28   (f) ADJUSTED    1 1
BH0937
BH0937.Superseded values are not recommended for survey control.
BH0937.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH0937.See file dsdata.txt to determine how the superseded data were derived.
BH0937
BH0937_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU7622756972(NAD 83)
BH0937_MARKER: DJ = TIDAL STATION DISK
BH0937_SETTING: 32 = SET IN A RETAINING WALL OR CONCRETE LEDGE
BH0937_SP_SET: SET IN THE TOP OF A LOW CONCRETE
BH0937_STAMPING: NO.1 MS-04 1968
BH0937_MARK LOGO: CGS
BH0937_MAGNETIC: N = NO MAGNETIC MATERIAL
BH0937_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
BH0937+STABILITY: SURFACE MOTION
BH0937_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH0937+SATELLITE: SATELLITE OBSERVATIONS - March 06, 2006
BH0937
BH0937  HISTORY     - Date     Condition        Report By
```

```
 BH0937  HISTORY     - 1968     MONUMENTED       CGS
 BH0937  HISTORY     - 1969     GOOD             CGS
 BH0937  HISTORY     - 1976     GOOD             USPSQD
 BH0937  HISTORY     - 1976     GOOD             NGS
 BH0937  HISTORY     - 20000901 GOOD             NGS
 BH0937  HISTORY     - 20060306 GOOD             3001
 BH0937
 BH0937                          STATION DESCRIPTION
 BH0937
 BH0937'DESCRIBED BY COAST AND GEODETIC SURVEY 1969
 BH0937'0.4 MI NW FROM BAY ST LOUIS.
 BH0937'ABOUT 0.05 MILE WEST ALONG U. S. HIGHWAY 90 FROM THE WEST END OF THE
 BH0937'BRIDGE OVER ST LOUIS BAY, THENCE 0.35 MILE NORTHWEST ALONG NORTH BEACH
 BH0937'BLVD, NEAR THE ENTRANCE TO THE BAY WAVELAND YACHT CLUB, SET IN THE TOP
 BH0937'OF A CONCRETE SEA WALL, 39 FEET NORTHWEST OF THE CENTER OF THE
 BH0937'ENTRANCE TO THE CLUB, 28 FEET NORTHWEST OF THE NORTHWEST STEEL GATE
 BH0937'POST AT ENTRANCE TO YATCH CLUB, 18 FEET NORTHEAST OF THE CENTER LINE
 BH0937'OF THE BLVD, 336 FEET NORTHWEST OF TIDAL BM 2 (1968) DESCRIBED AND
 BH0937'ABOUT LEVEL WITH THE BLVD.
 BH0937
 BH0937                          STATION RECOVERY (1976)
 BH0937
 BH0937'RECOVERY NOTE BY US POWER SQUADRON 1976 (WE)
 BH0937'RECOVERED IN GOOD CONDITION.
 BH0937
 BH0937                          STATION RECOVERY (1976)
 BH0937
 BH0937'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1976
 BH0937'RECOVERED IN GOOD CONDITION.
 BH0937
 BH0937                          STATION RECOVERY (2000)
 BH0937
 BH0937'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2000
 BH0937'STATION IS LOCATED ON THE NORTHEAST SIDE OF BAY ST. LOUIS, MS, NEAR
 BH0937'THE SHORE OF ST. LOUIS BAY.  THE STATION MARK IS SET IN THE TOP OF THE
 BH0937'LOW CONCRETE SEA WALL AT THE ENTRANCE OF THE BAY WAVELAND YACHT CLUB,
 BH0937'39 FT (11.9 M) NW OF THE CENTER OF THE ENTRANCE DRIVE, 28 FT (8.5 M)
 BH0937'NW OF THE NW STEEL GATE POST, AND 18 FT (5.5 M) NE OF THE CENTERLINE
 BH0937'OF NORTH BEACH BLVD.  TO REACH FROM THE INTERSECTION OF US HWY 90 AND
 BH0937'NORTH BEACH BLVD. AT THE EAST EDGE OF BAY ST. LOUIS (AND THE WEST END
 BH0937'OF THE US 90 BRIDGE OVER ST. LOUIS BAY), DRIVE NORTH ON NORTH BEACH
 BH0937'BLVD. 0.4 MI (0.6 KM) TO THE YACHT CLUB AND THE MARK ON THE RIGHT.
 BH0937
 BH0937                          STATION RECOVERY (2006)
 BH0937
 BH0937'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 BH0937'THE STATION IS LOCATED ON THE NORTHEAST SIDE OF BAY ST.  LOUIS,
 BH0937'MISSISSIPPI, ON THE WEST SIDE OF THE U.S. 90 BRIDGE OVER ST.  LOUIS
 BH0937'BAY.  OWNERSHIP - UNKNOWN   TO REACH THE STATION FROM THE INTERSECTION
 BH0937'OF HIGHWAY 90 AND NORTH BEACH BLVD., DRIVE NORTH ON NORTH BEACH BLVD.
 BH0937'0.4 MI (0.64 KM) TO THE YACHT CLUB AND THE MARK ON THE RIGHT.  THE
 BH0937'STATION IS A BRASS DISK SET IN THE TOP OF A LOW CONCRETE SEAWALL AT
 BH0937'THE ENTRANCE OF THE BAY WAVELAND YACHT CLUB, 39 FT (11.9 M) NORTHWEST
 BH0937'OF THE YACHT CLUB ENTRANCE DRIVE CENTERLINE, 28 FT (8.5 M) NORTHWEST
 BH0937'OF THE NORTHWEST STEEL GATE POST, AND 18 FT (5.5 M) NORTHEAST OF THE
 BH0937'NORTH BEACH BLVD.  CENTERLINE.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 DH9067 ***********************************************************************
 DH9067  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 DH9067  DESIGNATION -  876 1494 C TIDAL
 DH9067  PID         -  DH9067
 DH9067  STATE/COUNTY-  LA/PLAQUEMINES
 DH9067  USGS QUAD   -  POINTE A LA HACHE (1992)
```

```
DH9067
DH9067                         *CURRENT SURVEY CONTROL
DH9067  ___________________________________________________________________
DH9067* NAD 83(1992)-  29 34 19.21106(N)    089 48 13.15403(W)     ADJUSTED
DH9067* NAVD 88     -         0.58 **(meters)       1.9  **(feet)  GPS OBS(2004.65)
DH9067  **This station is located in a subsidence area (see below).
DH9067  ___________________________________________________________________
DH9067  EPOCH DATE  -        2004.65
DH9067  X           -      19,025.360 (meters)                     COMP
DH9067  Y           -  -5,551,770.851 (meters)                     COMP
DH9067  Z           -   3,129,186.792 (meters)                     COMP
DH9067  LAPLACE CORR-           0.49  (seconds)                    DEFLEC99
DH9067  ELLIP HEIGHT-         -24.14  (meters)          (04/11/06) GPS OBS
DH9067  GEOID HEIGHT-         -24.73  (meters)                     GEOID03
DH9067
DH9067  HORZ ORDER  -  B
DH9067  ELLP ORDER  -  FOURTH    CLASS II
DH9067
DH9067.The horizontal coordinates were established by GPS observations
DH9067.and adjusted by the National Geodetic Survey in April 2006..
DH9067.The horizontal coordinates are valid at the epoch date displayed above.
DH9067.The epoch date for horizontal control is a decimal equivalence
DH9067.of Year/Month/Day.
DH9067
DH9067 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
DH9067 ** and geoid heights are valid at the date of observation. These heights
DH9067 ** must always be validated when used as control.
DH9067 ** The orthometric height was determined by GPS observations using
DH9067 ** precise GPS observation and processing techniques and a new
DH9067 ** realization of GEOID03. It supersedes the leveled height previously
DH9067 ** determined for this station.
DH9067 ** The geoid height was determined by a new realization of GEOID03 for the
DH9067 ** epoch indicated which incorporates improved geoid heights for the
DH9067 ** Southern Louisiana Subsidence area.
DH9067 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
DH9067.The orthometric height was determined by GPS observations and a
DH9067.high-resolution geoid model using precise GPS observation and
DH9067.processing techniques.
DH9067
DH9067.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DH9067
DH9067.The Laplace correction was computed from DEFLEC99 derived deflections.
DH9067
DH9067.The ellipsoidal height was determined by GPS observations
DH9067.and is referenced to NAD 83.
DH9067
DH9067.The geoid height was determined by GEOID03.
DH9067
DH9067;                    North         East     Units Scale Factor Converg.
DH9067;SPC LA S     -   119,815.801 1,148,211.007   MT  0.99995357   +0 45 53.5
DH9067;SPC LA S     -   393,095.67  3,767,088.95   sFT  0.99995357   +0 45 53.5
DH9067;UTM  16      - 3,274,642.674   228,385.294   MT  1.00051039   -1 23 04.2
DH9067
DH9067!             -  Elev Factor  x  Scale Factor =   Combined Factor
DH9067!SPC LA S     -   1.00000379  x   0.99995357  =   0.99995736
DH9067!UTM  16      -   1.00000379  x   1.00051039  =   1.00051418
DH9067
DH9067                          SUPERSEDED SURVEY CONTROL
DH9067
DH9067.No superseded survey control is available for this station.
DH9067
DH9067_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBT2838574643(NAD 83)
DH9067_MARKER: DJ = TIDAL STATION DISK
```

```
 DH9067_SETTING: 35 = SET IN A MAT FOUNDATION OR CONCRETE SLAB OTHER THAN
 DH9067+WITH SETTING: PAVEMENT
 DH9067_SP_SET: SET
 DH9067_MARK LOGO: NOS
 DH9067_MAGNETIC: N = NO MAGNETIC MATERIAL
 DH9067_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 DH9067_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 DH9067+SATELLITE: SATELLITE OBSERVATIONS - January 23, 2006
 DH9067
 DH9067  HISTORY     - Date     Condition        Report By
 DH9067  HISTORY     - UNK      MONUMENTED       NOS
 DH9067  HISTORY     - 20060123 GOOD             3001
 DH9067
 DH9067                          STATION DESCRIPTION
 DH9067
 DH9067'DESCRIBED BY 3001, INC 2006 (JCP)
 DH9067'THE STATION IS LOCATED IN WEST POINT-A-LA-HACHE, 19.5 MI (31.38 KM)
 DH9067'SOUTHEAST OF LAFITTE, 9.1 MI (14.65 KM) NORTHWEST OF PORT SULPHUR.
 DH9067'OWNERSHIP - PORT SULPHUR WATER WORKS DEPARTMENT.
 DH9067'
 DH9067'TO REACH THE STATION FROM THE INTERSECTION OF HIGHWAYS 23 AND 406 IN
 DH9067'BELLE CHASSE, GO SOUTHEAST ON HIGHWAY 23 FOR 28.3 MI (45.54 KM) TO THE
 DH9067'PORT SULPHUR WATER WORKS PLANT ON THE LEFT.  TURN LEFT ON A GRAVEL
 DH9067'ROAD LOCATED ON THE NORTHWEST SIDE OF THE FACILITY.  FOLLOW THE GRAVEL
 DH9067'ROAD APPROXIMATELY 450 FT (137.2 M) TO ANOTHER GRAVEL ROAD LEADING
 DH9067'NORTHEAST.  FOLLOW THE GRAVEL ROAD NORTHEAST APPROXIMATELY 200 FT
 DH9067'(61.0 M) TO THE MARK ON THE LEFT.  THE STATION IS A BRASS DISK SET IN
 DH9067'CONCRETE SLAB LOCATED NEAR THE NORTHEAST CORNER OF THE 8X17X0.75 FT
 DH9067'(2.4 M) SLAB, 7.3 FT (2.2 M) NORTHEAST OF THE SOUTHEAST CORNER OF THE
 DH9067'SLAB, 23.3 FT (7.1 M) NORTHEAST OF THE NORTHEAST CORNER OF A PIPE
 DH9067'RACK, 0.8 FT (0.2 M) SOUTHWEST OF THE NORTHEAST CORNER OF THE CONCRETE
 DH9067'SLAB.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AT1392 ***********************************************************************
 AT1392  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AT1392  TIDAL BM     -  This is a Tidal Bench Mark.
 AT1392  DESIGNATION -  876 1602 C TIDAL
 AT1392  PID          -  AT1392
 AT1392  STATE/COUNTY-  LA/PLAQUEMINES
 AT1392  USGS QUAD   -  LAKE LAURIER (1992)
 AT1392
 AT1392                         *CURRENT SURVEY CONTROL
 AT1392  ___________________________________________________________________
 AT1392* NAD 83(1992)-  29 33 33.83227(N)    089 53 05.03636(W)     ADJUSTED
 AT1392* NAVD 88     -         0.16 **(meters)       0.5  **(feet)  GPS OBS(2004.65)
 AT1392  **This station is located in a subsidence area (see below).
 AT1392  ___________________________________________________________________
 AT1392  EPOCH DATE  -       2004.65
 AT1392  X           -      11,170.500 (meters)                     COMP
 AT1392  Y           -  -5,552,481.276 (meters)                     COMP
 AT1392  Z           -   3,127,971.300 (meters)                     COMP
 AT1392  LAPLACE CORR-           0.61  (seconds)                    DEFLEC99
 AT1392  ELLIP HEIGHT-         -24.55  (meters)          (04/11/06) GPS OBS
 AT1392  GEOID HEIGHT-         -24.72  (meters)                     GEOID03
 AT1392
 AT1392  HORZ ORDER  -  B
 AT1392  ELLP ORDER  -  FOURTH    CLASS II
 AT1392
 AT1392.The horizontal coordinates were established by GPS observations
 AT1392.and adjusted by the National Geodetic Survey in April 2006..
 AT1392.The horizontal coordinates are valid at the epoch date displayed above.
 AT1392.The epoch date for horizontal control is a decimal equivalence
 AT1392.of Year/Month/Day.
```

```
AT1392
AT1392 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AT1392 ** and geoid heights are valid at the date of observation. These heights
AT1392 ** must always be validated when used as control.
AT1392 ** The orthometric height was determined by GPS observations using
AT1392 ** precise GPS observation and processing techniques and a new
AT1392 ** realization of GEOID03. It supersedes the leveled height previously
AT1392 ** determined for this station.
AT1392 ** The geoid height was determined by a new realization of GEOID03 for the
AT1392 ** epoch indicated which incorporates improved geoid heights for the
AT1392 ** Southern Louisiana Subsidence area.

AT1392 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AT1392.The orthometric height was determined by GPS observations and a
AT1392.high-resolution geoid model using precise GPS observation and
AT1392.processing techniques.
AT1392
AT1392.This Tidal Bench Mark is designated as VM 15137
AT1392.by the Center for Operational Oceanographic Products and Services.
AT1392
AT1392.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AT1392
AT1392.The Laplace correction was computed from DEFLEC99 derived deflections.
AT1392
AT1392.The ellipsoidal height was determined by GPS observations
AT1392.and is referenced to NAD 83.
AT1392
AT1392.The geoid height was determined by GEOID03.
AT1392
AT1392;                    North         East     Units Scale Factor Converg.
AT1392;SPC LA S     -   118,316.659 1,140,373.391   MT  0.99995523   +0 43 27.5
AT1392;SPC LA S     -   388,177.24  3,741,375.03   sFT  0.99995523   +0 43 27.5
AT1392;UTM  16      - 3,273,437.764   220,492.381   MT  1.00056408   -1 25 26.5
AT1392
AT1392!             -  Elev Factor  x  Scale Factor =   Combined Factor
AT1392!SPC LA S     -   1.00000386  x   0.99995523  =   0.99995909
AT1392!UTM  16      -   1.00000386  x   1.00056408  =   1.00056794
AT1392
AT1392                         SUPERSEDED SURVEY CONTROL
AT1392
AT1392  ELLIP H (09/30/02)  -24.50   (m)                       GP(        ) 4 2
AT1392  NAD 83(1992)-  29 33 33.83137(N)    089 53 05.03563(W) AD(        ) 1
AT1392  ELLIP H (01/21/93)  -24.50   (m)                       GP(        ) 4 2
AT1392  NAD 83(1986)-  29 33 33.84850(N)    089 53 05.03545(W) AD(        ) 1
AT1392  NAD 27      -  29 33 33.07216(N)    089 53 04.79385(W) AD(        ) 1
AT1392  NGVD 29 (05/20/88)    0.6    (m)            2.     (f) GPS OBS
AT1392
AT1392.Superseded values are not recommended for survey control.
AT1392.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AT1392.See file dsdata.txt to determine how the superseded data were derived.
AT1392
AT1392_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBT2049273438(NAD 83)
AT1392_MARKER: DJ = TIDAL STATION DISK
AT1392_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AT1392_SP_SET: STAINLESS STEEL ROD
AT1392_STAMPING: 1602 C 1985
AT1392_MARK LOGO: NOS
AT1392_PROJECTION: FLUSH
AT1392_MAGNETIC: N = NO MAGNETIC MATERIAL
AT1392_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AT1392_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AT1392+SATELLITE: SATELLITE OBSERVATIONS - February 24, 2006
AT1392_ROD/PIPE-DEPTH: 22.0 meters
```

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AT1392
AT1392  HISTORY     - Date     Condition        Report By
AT1392  HISTORY     - UNK      MONUMENTED
AT1392  HISTORY     - 1987     GOOD             LADTD

AT1392  HISTORY     - 19880920 GOOD             LADTD
AT1392  HISTORY     - 19890118 GOOD
AT1392  HISTORY     - 20050301 GOOD             INDIV
AT1392  HISTORY     - 20060224 GOOD             3001
AT1392
AT1392                          STATION DESCRIPTION
AT1392
AT1392'DESCRIBED BY LA TRANSP AND DEV 1987 (TLH)
AT1392'THE DESIGNATED MARK WAS RECOVERED AS PREVIOUSLY DESCRIBED.
AT1392'A COMPLETE NEW DESCRIPTION FOLLOWS.
AT1392'
AT1392'THE STATION IS LOCATED ABOUT 8 KM (5 MI) SOUTH OF THE JUNCTION OF
AT1392'STATE HIGHWAY 23 AND LAKE JUDGE PEREZ ROAD, IN PLAQUEMINES PARISH,
AT1392'IN PORT SULPHUR, LA.
AT1392'OWNERSHIP--ALFRED J LEBLANC, RFD NO 1 BOX 113, LAKE JUDGE PEREZ
AT1392'ROAD, PORT SULPHUR, LA.
AT1392'
AT1392'TO REACH THE STATION FROM MYRTLE GROVE GO SOUTHEAST ON STATE
AT1392'HIGHWAY 23 TO MILE MARKER 45.7.
AT1392'TURN RIGHT AND GO EAST FOR 8 KM (5 MI) ON LAKE JUDGE PEREZ ROAD TO
AT1392'A FIRE STATION ON THE RIGHT AND THE BENCH MARK ON THE LEFT.
AT1392'
AT1392'THE STATION IS A STANDARD NOS DISK
AT1392'STAMPED---1602 C 1985--- CRIMPED TO A STEEL ROD DRIVEN 22 METERS
AT1392'(72 FT) INTO THE GROUND AND ENCASED IN A 5-INCH PVC PIPE SURROUNDED
AT1392'BY CONCRETE.
AT1392'29 METERS (95.2 FT) NORTH FROM THE NORTH CORNER OF THE FIRE STATION,
AT1392'21.8 METERS (71.4 FT) EAST FROM A POWER POLE AND
AT1392'0.5 METERS (1.8 FT) SOUTHWEST FROM A WITNESS POST.
AT1392
AT1392                          STATION RECOVERY (1988)
AT1392
AT1392'RECOVERY NOTE BY LA TRANSP AND DEV 1988
AT1392'THE STATION IS LOCATED ABOUT 8 KM (4.95 MI) SOUTH OF THE JUNCTION OF
AT1392'STATE HIGHWAY 23 AND LAKE JUDGE PEREZ ROAD IN PORT SULPHUR, LA.
AT1392'OWNERSHIP--ALFORD J. LABLANC, RFD NO 1 BOX 113, LAKE JUDGE PEREZ ROAD,
AT1392'PORT SULPHUR, LA.
AT1392'TO REACH THE STATION FROM MYRTLE GROVE GO SOUTHEAST ON STATE HIGHWAY
AT1392'23 TO MILE MARKER 45.7.  TURN RIGHT AND GO EAST FOR 8 KM (4.95 MI) ON
AT1392'LAKE JUDGE PEREZ ROAD TO A FIRE STATION ON THE RIGHT AND THE BENCH
AT1392'MARK ON THE LEFT.
AT1392'THE STATION IS 29 M (95.1 FT) NORTH FROM THE NORTH CORNER OF THE FIRE
AT1392'STATION, 21.8 M (71.5 FT) EAST FROM A POWER POLE AND 0.5 M (1.6 FT)
AT1392'SOUTHWEST FROM A WITNESS POST.
AT1392
AT1392                          STATION RECOVERY (1989)
AT1392
AT1392'RECOVERED 1989
AT1392'RECOVERED IN GOOD CONDITION.
AT1392
AT1392                          STATION RECOVERY (2005)
AT1392
AT1392'RECOVERY NOTE BY INDIVIDUAL CONTRIBUTORS 2005 (TG)
AT1392'RECOVERED AS DESCRIBED
AT1392
AT1392                          STATION RECOVERY (2006)
AT1392
AT1392'RECOVERY NOTE BY 3001, INC 2006 (JCP)
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 AT1392'THE STATION IS LOCATED IN ORLEANS PARISH AT FORT PIKE ON THE WEST END
 AT1392'OF THE RIGOLETTS BRIDGE 8.0 MI (12.87 KM) SOUTHEAST OF SLIDELL.
 AT1392'OWNERSHIP - LADOT   TO REACH THE STATION FROM THE INTERSECTION OF
 AT1392'I-10, EXIT 263, AND HIGHWAY 433 IN SLIDELL, GO 6.5 MI (10.46 KM)
 AT1392'SOUTHEAST ALONG HIGHWAY 433 TO THE JUNCTION OF HIGHWAY 90, TURN RIGHT
 AT1392'ON HIGHWAY 90 AND GO 0.95 MI (1.53 KM), CROSSING THE RIGOLETTS BRIDGE
 AT1392'TO THE MARK ON THE SOUTH SIDE OF HIGHWAY 90.  THE STATION IS A BRASS
 AT1392'DISK SET IN THE CENTER OF A RED CONCRETE PAD, 114.2 FT (34.8 M)
 AT1392'SOUTHEAST OF THE HIGHWAY 90 CENTERLINE, 83.7 FT (27.4 M) SOUTH OF THE
 AT1392'BENCHMARK C 193, 67.3 FT (79.3 M) WEST OF TRIANGULATION STATION PIKE
 AT1392'RESET, 9.5 FT (2.9 M) NORTHEAST OF THE SOUTHWEST CORNER OF THE RED
 AT1392'CONCRETE PAD.  THE FENCE MENTIONED IN THE PREVIOUS DESCRIPTIONS WAS
 AT1392'DESTROYED DURING THE KATRINA STORM.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 DH9066 ***********************************************************************
 DH9066  HT_MOD      -  This is a Louisiana Height Modernization Survey Station.
 DH9066  DESIGNATION -  876 1799 B TIDAL
 DH9066  PID         -  DH9066
 DH9066  STATE/COUNTY-  LA/JEFFERSON
 DH9066  USGS QUAD   -  BAY DOSGRIS (1994)
 DH9066
 DH9066                         *CURRENT SURVEY CONTROL
 DH9066  ___________________________________________________________________
 DH9066* NAD 83(1992)-  29 29 46.57411(N)    090 01 32.56821(W)     ADJUSTED
 DH9066* NAVD 88     -         0.77 **(meters)       2.5  **(feet)  GPS OBS(2004.65)
 DH9066  **This station is located in a subsidence area (see below).
 DH9066  ___________________________________________________________________
 DH9066  EPOCH DATE  -       2004.65
 DH9066  X           -     -2,493.414 (meters)                      COMP
 DH9066  Y           -  -5,555,941.148 (meters)                     COMP
 DH9066  Z           -   3,121,883.193 (meters)                     COMP
 DH9066  LAPLACE CORR-          0.81  (seconds)                     DEFLEC99
 DH9066  ELLIP HEIGHT-        -23.85  (meters)          (04/11/06) GPS OBS
 DH9066  GEOID HEIGHT-        -24.63  (meters)                      GEOID03
 DH9066
 DH9066  HORZ ORDER  -  B
 DH9066  ELLP ORDER  -  FOURTH    CLASS II
 DH9066
 DH9066.The horizontal coordinates were established by GPS observations
 DH9066.and adjusted by the National Geodetic Survey in April 2006..
 DH9066.The horizontal coordinates are valid at the epoch date displayed above.
 DH9066.The epoch date for horizontal control is a decimal equivalence
 DH9066.of Year/Month/Day.
 DH9066
 DH9066 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 DH9066 ** and geoid heights are valid at the date of observation. These heights
 DH9066 ** must always be validated when used as control.
 DH9066 ** The orthometric height was determined by GPS observations using
 DH9066 ** precise GPS observation and processing techniques and a new
 DH9066 ** realization of GEOID03. It supersedes the leveled height previously
 DH9066 ** determined for this station.
 DH9066 ** The geoid height was determined by a new realization of GEOID03 for the
 DH9066 ** epoch indicated which incorporates improved geoid heights for the
 DH9066 ** Southern Louisiana Subsidence area.
 DH9066 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 DH9066.The orthometric height was determined by GPS observations and a
 DH9066.high-resolution geoid model using precise GPS observation and
 DH9066.processing techniques.
 DH9066
 DH9066.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 DH9066
 DH9066.The Laplace correction was computed from DEFLEC99 derived deflections.
 DH9066
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DH9066.The ellipsoidal height was determined by GPS observations
DH9066.and is referenced to NAD 83.
DH9066

DH9066.The geoid height was determined by GEOID03.
DH9066
DH9066;                    North         East     Units Scale Factor Converg.
DH9066;SPC LA S     -   111,155.784 1,126,792.410   MT  0.99996426   +0 39 13.8
DH9066;SPC LA S     -   364,683.60  3,696,818.10   sFT  0.99996426   +0 39 13.8
DH9066;UTM  15      - 3,266,657.530   788,367.922   MT  1.00062619   +1 27 55.6
DH9066;UTM  16      - 3,266,786.251   206,643.680   MT  1.00066201   -1 29 27.0
DH9066
DH9066!             -  Elev Factor  x  Scale Factor =   Combined Factor
DH9066!SPC LA S     -   1.00000375  x   0.99996426  =   0.99996801
DH9066!UTM  15      -   1.00000375  x   1.00062619  =   1.00062994
DH9066!UTM  16      -   1.00000375  x   1.00066201  =   1.00066576
DH9066
DH9066                          SUPERSEDED SURVEY CONTROL
DH9066
DH9066.No superseded survey control is available for this station.
DH9066
DH9066_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYN8836866658(NAD 83)
DH9066_MARKER: DJ = TIDAL STATION DISK
DH9066_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
DH9066_STAMPING: 1799 B 1985
DH9066_MARK LOGO: NOS
DH9066_PROJECTION: PROJECTING 15 CENTIMETERS
DH9066_MAGNETIC: O = OTHER; SEE DESCRIPTION
DH9066_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
DH9066_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DH9066+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
DH9066
DH9066  HISTORY     - Date     Condition        Report By
DH9066  HISTORY     - UNK      MONUMENTED       NOS
DH9066  HISTORY     - 20060124 GOOD             3001
DH9066
DH9066                          STATION DESCRIPTION
DH9066
DH9066'DESCRIBED BY 3001, INC 2006 (JCP)
DH9066'THE STATION IS LOCATED IN JEFFERSON PARISH ALONG THE BARATARIA
DH9066'WATERWAY 12.8 MI (20.6 KM) SOUTHEAST OF LAFITTE, 16.8 MI (27.04 KM)
DH9066'NORTHEAST OF GALLIANO, 20.0 MI (32.19 KM) NORTHWEST OF PORT SULPHUR.
DH9066'OWNERSHIP - M.  V.  PETROLEUM   TO REACH THE STATION BY BOAT, DEPART
DH9066'FROM THE C-WAY MARINA IN LAFITTE.  PROCEED SOUTHEAST 12.45 MI (20.04
DH9066'KM) ALONG THE BARATARIA WATERWAY TO RED BEACON NO.  50.  TURN RIGHT
DH9066'INTO THE OPEN BAY AND PROCEED APPROX.  1000 FT (304.8 M) TO THE FIRST
DH9066'PLATFORM AND THE ENTRANCE OF AN OIL PLATFORM SLIP (CANAL).  TURN RIGHT
DH9066'INTO THE SLIP AND GO APPROX.  1200 FT (365.8 M) TO TWO STORAGE TANKS
DH9066'LOCATED IN THE NORTHWEST CORNER OF THE SLIP.  SECURE THE BOAT AND WALK
DH9066'NORTHWEST APPROX.  250 FT (76.2 M) TO THE STATION.  THE STATION IS A
DH9066'STAINLESS STEEL ROD WITH BRASS CAP PROJECTING 0.5 FT (0.2 M) ABOVE THE
DH9066'GROUND, 200 FT (61.0 M) NORTHWEST OF THE FACE OF THE NORTHERN MOST OF
DH9066'THE TWO STORAGE TANKS, 249 FT (75.9 M) NORTHWEST OF BENCHMARK 1799 A
DH9066'1985, 247 FT (680.3 M) SOUTH OF BENCHMARK 1799 C 1985, AND APPROX.  15
DH9066'FT (4.6 M) NORTHWEST OF THE SLIP BANKLINE.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
AU2310 ***********************************************************************
AU2310  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
AU2310  TIDAL BM     -  This is a Tidal Bench Mark.
AU2310  DESIGNATION -  876 1899 B TIDAL
AU2310  PID          -  AU2310
AU2310  STATE/COUNTY-  LA/JEFFERSON
AU2310  USGS QUAD    -  LAFITTE (1973)
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AU2310
AU2310                         *CURRENT SURVEY CONTROL
AU2310  ___________________________________________________________________
AU2310* NAD 83(1992)-  29 40 02.04338(N)    090 06 33.55624(W)     ADJUSTED
AU2310* NAVD 88     -          0.01 **(meters)       0.0  **(feet)  LEVELING(2004.65)
AU2310  **This station is located in a subsidence area (see below).
AU2310  **This station is included in the VTDP model (see below).
AU2310  ___________________________________________________________________
AU2310  EPOCH DATE  -        2004.65
AU2310  X           -     -10,582.959 (meters)                     COMP
AU2310  Y           -  -5,546,575.285 (meters)                     COMP
AU2310  Z           -   3,138,362.852 (meters)                     COMP
AU2310  LAPLACE CORR-           0.59  (seconds)                    DEFLEC99
AU2310  ELLIP HEIGHT-         -25.17  (meters)         (06/22/05) GPS OBS
AU2310  GEOID HEIGHT-         -25.19  (meters)                     GEOID03
AU2310
AU2310  HORZ ORDER  -  B
AU2310  VERT ORDER  -  THIRD
AU2310  ELLP ORDER  -  FOURTH    CLASS I
AU2310
AU2310.The horizontal coordinates were established by GPS observations
AU2310.and adjusted by the National Geodetic Survey in April 2006..
AU2310.The horizontal coordinates are valid at the epoch date displayed above.
AU2310.The epoch date for horizontal control is a decimal equivalence
AU2310.of Year/Month/Day.
AU2310
AU2310 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AU2310 ** and geoid heights are valid at the date of observation. These heights
AU2310 ** must always be validated when used as control.
AU2310 ** The orthometric height was determined with a Vertical Time-dependent
AU2310 ** Positioning (VTDP) model and has been validated through GPS observations
AU2310 ** for the epoch indicated (see www.ngs.noaa.gov/heightmod/VTDP).
AU2310 ** The geoid height was determined by a new realization of GEOID03 for the
AU2310 ** epoch indicated which incorporates improved geoid heights for the
AU2310 ** Southern Louisiana Subsidence area
AU2310 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AU2310.The orthometric height was determined by differential leveling.
AU2310.The vertical network tie was performed by a horz. field party for horz.
AU2310.obs reductions. Reset procedures were used to establish the elevation.
AU2310
AU2310.This Tidal Bench Mark is designated as VM 11049
AU2310.by the Center for Operational Oceanographic Products and Services.
AU2310
AU2310.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AU2310
AU2310.The Laplace correction was computed from DEFLEC99 derived deflections.
AU2310
AU2310.The ellipsoidal height was determined by GPS observations
AU2310.and is referenced to NAD 83.
AU2310
AU2310.The geoid height was determined by GEOID03.
AU2310
AU2310;                    North         East     Units Scale Factor Converg.
AU2310;SPC LA S     -   130,014.795 1,118,483.349   MT  0.99994259   +0 36 43.3
AU2310;SPC LA S     -   426,556.87  3,669,557.45   sFT  0.99994259   +0 36 43.3
AU2310;UTM  15      - 3,285,408.395   779,785.708   MT  1.00056598   +1 25 54.1
AU2310
AU2310!             -  Elev Factor  x  Scale Factor =   Combined Factor
AU2310!SPC LA S     -   1.00000395  x   0.99994259  =   0.99994654
AU2310!UTM  15      -   1.00000395  x   1.00056598  =   1.00056994
AU2310
AU2310                          SUPERSEDED SURVEY CONTROL
AU2310
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AU2310  NAD 83(1992)-  29 40 02.04511(N)    090 06 33.55694(W) AD(2004.65) B
AU2310  NAVD 88 (12/05/96)    0.141  (m)            0.46   (f) ADJUSTED    1 2
AU2310  NAVD 88 (02/14/94)    0.094  (m)            0.31   (f) UNKNOWN     1 2
AU2310
AU2310.Superseded values are not recommended for survey control.
AU2310.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AU2310.See file dsdata.txt to determine how the superseded data were derived.
AU2310
AU2310_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYN7978685408(NAD 83)
AU2310_MARKER: I = METAL ROD
AU2310_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AU2310_SP_SET: STAINLESS STEEL ROD
AU2310_STAMPING: 1899 B 1985
AU2310_MARK LOGO: NOS
AU2310_PROJECTION: RECESSED 15 CENTIMETERS
AU2310_MAGNETIC: O = OTHER; SEE DESCRIPTION
AU2310_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AU2310_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AU2310+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
AU2310_ROD/PIPE-DEPTH: 24.4 meters
AU2310
AU2310  HISTORY     - Date     Condition        Report By
AU2310  HISTORY     - 1985     MONUMENTED       NOS
AU2310  HISTORY     - 1985     GOOD             LA-051
AU2310  HISTORY     - 19940826 GOOD             NGS
AU2310  HISTORY     - 20040416 GOOD             NGS
AU2310  HISTORY     - 20060124 GOOD             3001
AU2310
AU2310                          STATION DESCRIPTION
AU2310
AU2310'DESCRIBED BY JEFFERSON PARISH LOUISIANA 1985
AU2310'IN LAFITTE.
AU2310'AT LAFITTE, FROM THE JUNCTION OF LOUISIANA HGIGHWAY 45 AND MARRERO
AU2310'STREET TURN LEFT AND PROCEED .05 MILE TO THE JUNCTION OF 3RD STREET,
AU2310'LOCATED ON MARRERO STREET NEAR THE NORTHEST CORNER OF A BASKETBALL
AU2310'COURT, 237.0 FEET SOUTHEAST OF TIDAL MARK 876 1899 A, 63.0 FEET
AU2310'NORTH-NORTHEAST OF THE SOUTHEAST CORNER OF A CHAIN LINK FENCE AROUND
AU2310'THE BASKETBALL COURT, 57.0 FEET WEST-SOUTHWEST OF A POWER POLE ON THE
AU2310'EAST SIDE OF MARRERO STREET (POLE BEARING STREET SIGN OF MARRERO AND
AU2310'3RD STREET), 42.4 FEET NORTHEAST OF THE EASTERN MOST BASKETBALL POST,
AU2310'32 FEET WEST OF THE CENTERLINE OF MARRERO STREET.
AU2310'THE MARK IS 1 FT  W FROM A WITNESS POST.
AU2310
AU2310                          STATION RECOVERY (1994)
AU2310
AU2310'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
AU2310'14.4 KM (8.95 MI) SOUTHERLY ALONG STATE HIGHWAY 45 FROM THE JUNCTION
AU2310'OF STATE HIGHWAYS 303 AND 3134 IN CROWN POINT, THENCE 0.1 KM (0.05 MI)
AU2310'SOUTHERLY ALONG MARRERO STREET, 9.8 M (32.2 FT) WEST OF THE CENTERLINE
AU2310'OF MARRERO STREET, 6.3 M (20.7 FT) SOUTHEAST OF THE NORTHEAST CORNER
AU2310'OF A CHAIN-LINK FENCE ENCLOSING A BASKETBALL COURT, 5.3 M (17.4 FT)
AU2310'SOUTH OF THE CENTER OF THIRD STREET, AND 0.3 M (1.0 FT) BELOW THE
AU2310'LEVEL OF MARRERO STREET.  NOTE--THE DISK IS ENCASED IN A 5-INCH PCV
AU2310'PIPE AND IS FLUSH WITH THE GROUND SURFACE.
AU2310
AU2310                          STATION RECOVERY (2004)
AU2310
AU2310'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
AU2310'9 MI SOUTH ON STATE HWY 45 FROM THE JUNCTION WITH 303 AND 3134 IN
AU2310'CROWN POINT.  LOCATED  AT THE LOWER LAFITTE PLAYGROUND. IT IS 32.2 FT
AU2310'W OF THE CENTERLINE OF US 45, 20.8 FT SE OF  THE NE CORNER OF THE
AU2310'FENCE AROUND THE BASKETBALL COURT, 18.1 FT EAST OF THE FIRST POST
AU2310'SOUTH OF THE NE CORNER POST, 34.6 FT NNE OF THE NORTHERN MOST SIGN
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 AU2310'POST FOR THE LOWER  LAFFITE PLAYGROUND.
 AU2310
 AU2310                          STATION RECOVERY (2006)
 AU2310
 AU2310'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AU2310'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006

 AT0407 ***********************************************************************
 AT0407  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AT0407  DESIGNATION -  A 152
 AT0407  PID         -  AT0407
 AT0407  STATE/COUNTY-  LA/PLAQUEMINES
 AT0407  USGS QUAD   -  LAKE LAURIER (1992)
 AT0407
 AT0407                         *CURRENT SURVEY CONTROL
 AT0407  ___________________________________________________________________
 AT0407* NAD 83(1992)-  29 37 28.58854(N)    089 54 10.66914(W)     ADJUSTED
 AT0407* NAVD 88     -         0.67 **(meters)       2.2  **(feet)  GPS OBS(2004.65)
 AT0407  **This station is located in a subsidence area (see below).
 AT0407  ___________________________________________________________________
 AT0407  EPOCH DATE  -       2004.65
 AT0407  X           -       9,397.673 (meters)                     COMP
 AT0407  Y           -  -5,548,915.372 (meters)                     COMP
 AT0407  Z           -   3,134,256.848 (meters)                     COMP
 AT0407  LAPLACE CORR-           0.46  (seconds)                    DEFLEC99
 AT0407  ELLIP HEIGHT-         -24.25  (meters)         (06/22/05) GPS OBS
 AT0407  GEOID HEIGHT-         -24.93  (meters)                     GEOID03
 AT0407  DYNAMIC HT  -           0.67  (meters)       2.2   (feet)  COMP
 AT0407  MODELED GRAV-     979,304.9   (mgal)                       NAVD 88
 AT0407
 AT0407  HORZ ORDER  -  B
 AT0407  VERT ORDER  -  THIRD (See Below)
 AT0407  ELLP ORDER  -  FOURTH    CLASS I
 AT0407
 AT0407.The horizontal coordinates were established by GPS observations
 AT0407.and adjusted by the National Geodetic Survey in June 2005..
 AT0407.The horizontal coordinates are valid at the epoch date displayed above.
 AT0407.The epoch date for horizontal control is a decimal equivalence
 AT0407.of Year/Month/Day.
 AT0407
 AT0407 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 AT0407 ** and geoid heights are valid at the date of observation. These heights
 AT0407 ** must always be validated when used as control.
 AT0407 ** The orthometric height was determined by GPS observations using
 AT0407 ** precise GPS observation and processing techniques and a new
 AT0407 ** realization of GEOID03. It supersedes the leveled height previously
 AT0407 ** determined for this station.
 AT0407 ** The geoid height was determined by a new realization of GEOID03 for the
 AT0407 ** epoch indicated which incorporates improved geoid heights for the
 AT0407 ** Southern Louisiana Subsidence area.
 AT0407 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 AT0407.The orthometric height was determined by GPS observations and a
 AT0407.high-resolution geoid model using precise GPS observation and
 AT0407.processing techniques. It supersedes the leveled height previously
 AT0407.determined for this station.
 AT0407.WARNING-GPS observations at this control monument resulted in a GPS
 AT0407.derived orthometric height which differed from the leveled height by
 AT0407.more than one decimeter (0.1 meter).
 AT0407.The vertical order pertains to the first NAVD 88 superseded value.
 AT0407
 AT0407.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 AT0407
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AT0407.The Laplace correction was computed from DEFLEC99 derived deflections.
AT0407
AT0407.The ellipsoidal height was determined by GPS observations
AT0407.and is referenced to NAD 83.
AT0407
AT0407.The geoid height was determined by GEOID03.
AT0407
AT0407.The dynamic height is computed by dividing the NAVD 88
AT0407.geopotential number by the normal gravity value computed on the
AT0407.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AT0407.degrees latitude (g = 980.6199 gals.).
AT0407
AT0407.The modeled gravity was interpolated from observed gravity values.
AT0407
AT0407;                    North         East     Units Scale Factor Converg.
AT0407;SPC LA S     -   125,521.799 1,138,516.597   MT  0.99994717   +0 42 54.7
AT0407;SPC LA S     -   411,816.10  3,735,283.20   sFT  0.99994717   +0 42 54.7
AT0407;UTM  16      - 3,280,711.979   218,906.187   MT  1.00057504   -1 26 09.3
AT0407
AT0407!             -  Elev Factor  x  Scale Factor =   Combined Factor
AT0407!SPC LA S     -   1.00000381  x   0.99994717  =   0.99995098
AT0407!UTM  16      -   1.00000381  x   1.00057504  =   1.00057885
AT0407
AT0407                          SUPERSEDED SURVEY CONTROL
AT0407
AT0407  NAVD 88 (02/14/94)    0.870  (m)           2.85   (f) READJUSTED  3
AT0407  NAVD 88 (06/15/91)    0.924  (m)           3.03   (f) UNKNOWN     1 1
AT0407  NGVD 29 (??/??/??)    0.962  (m)           3.16   (f) ADJUSTED    1 1
AT0407
AT0407.Superseded values are not recommended for survey control.
AT0407.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AT0407.See file dsdata.txt to determine how the superseded data were derived.
AT0407
AT0407_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBT1890680712(NAD 83)
AT0407_MARKER: DB = BENCH MARK DISK
AT0407_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AT0407_SP_SET: SET IN TOP OF CONCRETE MONUMENT
AT0407_STAMPING: A 152 1951
AT0407_MARK LOGO: CGS
AT0407_MAGNETIC: N = NO MAGNETIC MATERIAL
AT0407_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AT0407+STABILITY: SURFACE MOTION
AT0407_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AT0407+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
AT0407
AT0407  HISTORY     - Date     Condition        Report By
AT0407  HISTORY     - 1951     MONUMENTED       CGS
AT0407  HISTORY     - 1971     GOOD             NGS
AT0407  HISTORY     - 1984     GOOD             NGS
AT0407  HISTORY     - 20030608 GOOD             NGS
AT0407  HISTORY     - 20040419 GOOD             NGS
AT0407  HISTORY     - 20051006 GOOD             NGS
AT0407  HISTORY     - 20060124 GOOD             3001
AT0407
AT0407                          STATION DESCRIPTION
AT0407
AT0407'DESCRIBED BY NATIONAL GEODETIC SURVEY 1971
AT0407'7.2 MI NW FROM POINTE A LA HACHE.
AT0407'ABOUT 7.2 MILES NORTHWEST ALONG STATE HIGHWAY 39 FROM THE COURTHOUSE
AT0407'AT POINTE A LA HACHE, 2.15 MILES SOUTHEAST OF THE PHOENIX HIGH SCHOOL,
AT0407'33 FEET NORTHEAST OF THE CENTER LINE OF THE HIGHWAY, 54.0 FEET WEST OF
AT0407'THE WEST CORNER OF A TWO-STORY FRAME HOUSE, 36 FEET NORTHWEST OF THE
AT0407'CENTER LINE OF A DRIVEWAY, 24 FEET SOUTHEAST OF THE CENTER LINE OF A
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 AT0407'DRIVEWAY, 6 FEET EAST OF A POWER POLE, 5.5 FEET EAST OF A METAL
 AT0407'WITNESS POST, ABOUT LEVEL WITH THE HIGHWAY, AND SET IN THE TOP OF A
 AT0407'CONCRETE POST WHICH PROJECTS 2 INCHES.  SEC 44, T 16S, R 13E.
 AT0407
 AT0407                          STATION RECOVERY (1984)
 AT0407
 AT0407'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1984
 AT0407'RECOVERED IN GOOD CONDITION.
 AT0407
 AT0407                          STATION RECOVERY (2003)
 AT0407
 AT0407'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2003
 AT0407'NOW 1 FT SE OF STEEL POST (NO SIGN), AND ABOUT 3 FT SE OF NEW POLE
 AT0407'WITH LIGHT AND TRANSFORMER.  OLD POLE WAS CUT OFF ABOUT 15 FEET UP.
 AT0407
 AT0407                          STATION RECOVERY (2004)
 AT0407
 AT0407'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
 AT0407'THE STATION IS LOCATED ABOUT 2.0 MI SOUTH OF PHOENIX ON PRIVATE
 AT0407'PROPERTY.
 AT0407'
 AT0407'TO REACH THE STATION FROM THE PHOENIX HIGH SCHOOL, IN PHOENIX, GO
 AT0407'SOUTHERLY FOR 2.1 MI ON PARISH  ROAD 15 TO THE STATION ON THE RIGHT
 AT0407'JUST BEFORE REACHING A LARGE RAISED WOOD FRAME HOUSE ON  THE LEFT.
 AT0407'
 AT0407'THE STATION IS LOCATED 16.5 M WEST OF THE WEST CORNER OF THE FRONT
 AT0407'PORCH OF THE HOUSE, 10.6 M  SOUTHEAST OF THE CENTER OF THE ROAD, 1.2 M
 AT0407'SOUHT-SOUTHEST OF  A WOODEN UTILITY POLE WITH  METER, 0.4 M SOUTHWEST
 AT0407'OF A METAL POST, AND 0.3 M BELOW THE LEVEL OF THE ROAD.
 AT0407
 AT0407                          STATION RECOVERY (2005)
 AT0407
 AT0407'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2005 (KLF)
 AT0407'RECOVERED AS DESCRIBED
 AT0407
 AT0407                          STATION RECOVERY (2006)
 AT0407
 AT0407'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AT0407'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH1212 ***********************************************************************
 BH1212  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH1212  DESIGNATION -  A 193
 BH1212  PID         -  BH1212
 BH1212  STATE/COUNTY-  LA/ST TAMMANY
 BH1212  USGS QUAD   -  ENGLISH LOOKOUT (1996)
 BH1212
 BH1212                         *CURRENT SURVEY CONTROL
 BH1212  ___________________________________________________________________
 BH1212* NAD 83(1992)-  30 14 19.40273(N)    089 37 10.40720(W)     ADJUSTED
 BH1212* NAVD 88     -         0.81 **(meters)       2.7  **(feet)  GPS OBS(2004.65)
 BH1212  **This station is located in a subsidence area (see below).
 BH1212  **This station is included in the VTDP model (see below).
 BH1212  ___________________________________________________________________
 BH1212  EPOCH DATE  -       2004.65
 BH1212  X           -      36,618.883 (meters)                     COMP
 BH1212  Y           -  -5,514,833.117 (meters)                     COMP
 BH1212  Z           -   3,193,251.064 (meters)                     COMP
 BH1212  LAPLACE CORR-          -1.30  (seconds)                    DEFLEC99
 BH1212  ELLIP HEIGHT-         -26.03  (meters)         (06/22/05) GPS OBS
 BH1212  GEOID HEIGHT-         -26.83  (meters)                     GEOID03
 BH1212  DYNAMIC HT  -           0.81  (meters)       2.7   (feet)  COMP
 BH1212  MODELED GRAV-     979,336.4   (mgal)                       NAVD 88
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BH1212
BH1212  HORZ ORDER  -  B
BH1212  VERT ORDER  -  THIRD (See Below)
BH1212  ELLP ORDER  -  FOURTH    CLASS I
BH1212
BH1212.The horizontal coordinates were established by GPS observations
BH1212.and adjusted by the National Geodetic Survey in June 2005..
BH1212.The horizontal coordinates are valid at the epoch date displayed above.
BH1212.The epoch date for horizontal control is a decimal equivalence
BH1212.of Year/Month/Day.
BH1212
BH1212 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH1212 ** and geoid heights are valid at the date of observation. These heights
BH1212 ** must always be validated when used as control.
BH1212 ** The orthometric height was determined with a Vertical Time-dependent
BH1212 ** Positioning (VTDP) model and has been validated through GPS observations
BH1212 ** for the epoch indicated (see www.ngs.noaa.gov/heightmod/VTDP).
BH1212 ** The geoid height was determined by a new realization of GEOID03 for the
BH1212 ** epoch indicated which incorporates improved geoid heights for the
BH1212 ** Southern Louisiana Subsidence area
BH1212 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH1212.The orthometric height was determined by GPS observations and a
BH1212.high-resolution geoid model using precise GPS observation and
BH1212.processing techniques. It supersedes the leveled height previously
BH1212.determined for this station.
BH1212.The vertical order pertains to the first NAVD 88 superseded value.
BH1212
BH1212.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH1212
BH1212.The Laplace correction was computed from DEFLEC99 derived deflections.
BH1212
BH1212.The ellipsoidal height was determined by GPS observations
BH1212.and is referenced to NAD 83.
BH1212
BH1212.The geoid height was determined by GEOID03.
BH1212
BH1212.The dynamic height is computed by dividing the NAVD 88
BH1212.geopotential number by the normal gravity value computed on the
BH1212.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH1212.degrees latitude (g = 980.6199 gals.).
BH1212
BH1212.The modeled gravity was interpolated from observed gravity values.
BH1212
BH1212;                     North         East     Units Scale Factor Converg.
BH1212;SPC LA S     -   193,961.478 1,164,941.665   MT  0.99993433   +0 51 24.9
BH1212;SPC LA S     -   636,355.28  3,821,979.45   sFT  0.99993433   +0 51 24.9
BH1212;UTM  16      - 3,348,141.664   247,913.036   MT  1.00038407   -1 19 11.7
BH1212
BH1212!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH1212!SPC LA S     -   1.00000409  x   0.99993433  =   0.99993842
BH1212!UTM  16      -   1.00000409  x   1.00038407  =   1.00038816
BH1212
BH1212                         SUPERSEDED SURVEY CONTROL
BH1212
BH1212  NAVD 88 (02/14/94)    0.879  (m)            2.88   (f) ADJUSTED    1 1
BH1212  NAVD 88 (06/15/91)    0.879  (m)            2.88   (f) UNKNOWN     1 1
BH1212  NGVD 29 (??/??/??)    0.837  (m)            2.75   (f) ADJUSTED    1 1
BH1212
BH1212.Superseded values are not recommended for survey control.
BH1212.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH1212.See file dsdata.txt to determine how the superseded data were derived.
BH1212
BH1212_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU4791348142(NAD 83)
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BH1212_MARKER: DB = BENCH MARK DISK
BH1212_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
BH1212_SP_SET: COPPER-CLAD STEEL ROD
BH1212_STAMPING: A 193 1963
BH1212_MARK LOGO: CGS
BH1212_PROJECTION: RECESSED 5 CENTIMETERS
BH1212_MAGNETIC: N = NO MAGNETIC MATERIAL
BH1212_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
BH1212_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH1212+SATELLITE: SATELLITE OBSERVATIONS - March 06, 2006
BH1212_ROD/PIPE-DEPTH: 29.3 meters
BH1212
BH1212  HISTORY     - Date     Condition        Report By
BH1212  HISTORY     - 1963     MONUMENTED       CGS
BH1212  HISTORY     - 1970     GOOD             NGS
BH1212  HISTORY     - 1977     GOOD             NGS
BH1212  HISTORY     - 19930317 GOOD             NGS
BH1212  HISTORY     - 20040413 GOOD             NGS
BH1212  HISTORY     - 20060306 GOOD             3001
BH1212
BH1212                          STATION DESCRIPTION
BH1212
BH1212'DESCRIBED BY NATIONAL GEODETIC SURVEY 1970
BH1212'0.35 MI W FROM PEARLINGTON.
BH1212'ABOUT 0.35 MILE WEST ALONG U.S. HIGHWAY 90 FROM THE EAST END OF THE
BH1212'HIGHWAY BRIDGE OVER THE PEARL RIVER AT PEARLINGTON, 130 FEET NORTH OF
BH1212'THE CENTER LINE OF THE HIGHWAY, 29 FEET WEST OF A POWER POLE WITH A
BH1212'TRANSFORMER, 11 1/2 FEET EAST OF THE CENTER LINE OF A DRIVEWAY, 1.5
BH1212'FEET WEST OF A METAL WITNESS POST, ABOUT 5 FEET BELOW THE LEVEL OF THE
BH1212'HIGHWAY, AND ON THE TOP OF A COPPER COATED ROD THAT IS DRIVEN TO A
BH1212'DEPTH OF 96 FEET AND IS ENCASED IN A 4-INCH IRON PIPE WHICH IS 1 FOOT
BH1212'BELOW THE SURFACE OF THE GROUND.  SEC 30 ,T 9S,R 16W.
BH1212
BH1212                          STATION RECOVERY (1977)
BH1212
BH1212'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1977
BH1212'RECOVERED IN GOOD CONDITION.
BH1212
BH1212                          STATION RECOVERY (1993)
BH1212
BH1212'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1993
BH1212'0.9 KM (0.55 MI) WESTERLY ALONG U.S. HIGHWAY 90 FROM THE JUNCTION OF
BH1212'STATE HIGHWAY 604 IN PEARLINGTON, MISSISSIPPI, 39.7 M (130.2 FT)
BH1212'NORTH OF THE HIGHWAY CENTERLINE, 8.8 M (28.9 FT) WEST OF A UTILITY
BH1212'LIGHT POLE WITH 2 GUY CABLES AND A TRANSFORMER ATTACHED, 4.2 M (13.8
BH1212'FT) EAST OF THE CENTER OF A DRIVEWAY, 1.0 M (3.3 FT) BELOW THE LEVEL
BH1212'OF THE HIGHWAY, 0.6 M (2.0 FT) WEST OF A WITNESS POST, AND 0.3 M (1.0
BH1212'FT) SOUTHEAST OF A UTILITY POLE STUB.  NOTE--THE DISK IS ENCASED IN A
BH1212'4-INCH METAL PIPE AND IS FLUSH WITH THE GROUND SURFACE.  THE ORIGINAL
BH1212'DESCRIPTION STATES THAT THE MARK IS IN MISSISSIPPI, BUT IT IS IN
BH1212'LOUISIANA.
BH1212
BH1212                          STATION RECOVERY (2004)
BH1212
BH1212'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
BH1212'FROM EXIT 246, I 10 AND I 510 GO S ON I 510 FOR 2 MI. TO EXIT 2C, US
BH1212'HWY 90 AND GO GO TO THE  TRAFFIC LIGHT.  TURN LEFT, EASTERLY ON US 90,
BH1212'CHEF MENTEUR HWY, FOR 6.25 MI TO THE  JUNCTION WITH US 11. CONTINUE ON
BH1212'US 90 FOR 18.8 MI. TO THE JUNCTION OF US 190, CONTINUE  EASTERLY FOR
BH1212'3.7 MI. TO THE MARK ON THE LEFT. IT IS 0.35 MI WESTERLY FROM THE EAST
BH1212'END OF  THE BRIDGE OVER THE PEARL RIVER, 1 FT ENE OF A 4 FT POWER POLE
BH1212'STUB, 11.5 FT E OF A SHELL  DRIVE, 29 FT  W OF A POWER POLE WITH A
BH1212'TRANSFORMER,  AND 1 FOOT BELOW THE HIGHWAY.
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 BH1212
 BH1212                          STATION RECOVERY (2006)
 BH1212
 BH1212'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 BH1212'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BJ1342 ***********************************************************************
 BJ1342  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BJ1342  FBN          -  This is a Federal Base Network Control Station.
 BJ1342  TIDAL BM     -  This is a Tidal Bench Mark.
 BJ1342  DESIGNATION -  ALCO
 BJ1342  PID          -  BJ1342
 BJ1342  STATE/COUNTY-  LA/ORLEANS
 BJ1342  USGS QUAD   -  SPANISH FORT (1992)
 BJ1342
 BJ1342                         *CURRENT SURVEY CONTROL
 BJ1342  ___________________________________________________________________
 BJ1342* NAD 83(1992)-  30 01 36.52293(N)    090 06 46.21053(W)     ADJUSTED
 BJ1342* NAVD 88     -         1.87 **(meters)       6.1  **(feet)  LEVELING(2004.65)
 BJ1342  **This station is located in a subsidence area (see below).
 BJ1342  **This station is included in the VTDP model (see below).
 BJ1342  ___________________________________________________________________
 BJ1342  EPOCH DATE  -        2004.65
 BJ1342  X           -     -10,884.174 (meters)                     COMP
 BJ1342  Y           -  -5,526,738.134 (meters)                     COMP
 BJ1342  Z           -   3,172,935.170 (meters)                     COMP
 BJ1342  LAPLACE CORR-          -0.05  (seconds)                    DEFLEC99
 BJ1342  ELLIP HEIGHT-         -24.37  (meters)         (06/22/05) GPS OBS
 BJ1342  GEOID HEIGHT-         -26.24  (meters)                     GEOID03
 BJ1342  DYNAMIC HT  -           1.87  (meters)       6.1   (feet)  COMP
 BJ1342  MODELED GRAV-     979,318.9   (mgal)                       NAVD 88
 BJ1342
 BJ1342  HORZ ORDER  -  B
 BJ1342  VERT ORDER  -  THIRD
 BJ1342  ELLP ORDER  -  FOURTH    CLASS I
 BJ1342
 BJ1342.The horizontal coordinates were established by GPS observations
 BJ1342.and adjusted by the National Geodetic Survey in June 2005..
 BJ1342.The horizontal coordinates are valid at the epoch date displayed above.
 BJ1342.The epoch date for horizontal control is a decimal equivalence
 BJ1342.of Year/Month/Day.
 BJ1342
 BJ1342 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 BJ1342 ** and geoid heights are valid at the date of observation. These heights
 BJ1342 ** must always be validated when used as control.
 BJ1342 ** The orthometric height was determined with a Vertical Time-dependent
 BJ1342 ** Positioning (VTDP) model and has been validated through GPS observations
 BJ1342 ** for the epoch indicated (see www.ngs.noaa.gov/heightmod/VTDP).
 BJ1342 ** The geoid height was determined by a new realization of GEOID03 for the
 BJ1342 ** epoch indicated which incorporates improved geoid heights for the
 BJ1342 ** Southern Louisiana Subsidence area
 BJ1342 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 BJ1342.The orthometric height was determined by differential leveling.
 BJ1342.The vertical network tie was performed by a horz. field party for horz.
 BJ1342.obs reductions. Reset procedures were used to establish the elevation.
 BJ1342
 BJ1342.This Tidal Bench Mark is designated as VM 832
 BJ1342.by the Center for Operational Oceanographic Products and Services.
 BJ1342
 BJ1342.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 BJ1342
 BJ1342.The Laplace correction was computed from DEFLEC99 derived deflections.
 BJ1342
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BJ1342.The ellipsoidal height was determined by GPS observations
BJ1342.and is referenced to NAD 83.
BJ1342
BJ1342.The geoid height was determined by GEOID03.
BJ1342
BJ1342.The dynamic height is computed by dividing the NAVD 88
BJ1342.geopotential number by the normal gravity value computed on the
BJ1342.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BJ1342.degrees latitude (g = 980.6199 gals.).
BJ1342
BJ1342.The modeled gravity was interpolated from observed gravity values.
BJ1342
BJ1342;                    North        East     Units Scale Factor Converg.
BJ1342;SPC LA S     -   169,865.289 1,117,718.598   MT  0.99992585   +0 36 37.0
BJ1342;SPC LA S     -   557,299.70  3,667,048.43   sFT  0.99992585   +0 36 37.0
BJ1342;UTM  15      - 3,325,268.799   778,444.625   MT  1.00055667   +1 26 44.5
BJ1342
BJ1342!             -  Elev Factor  x  Scale Factor =   Combined Factor
BJ1342!SPC LA S     -   1.00000383  x   0.99992585  =   0.99992968
BJ1342!UTM  15      -   1.00000383  x   1.00055667  =   1.00056050
BJ1342
BJ1342:             Primary Azimuth Mark                     Grid Az
BJ1342:SPC LA S     -  BUICK                                    082 43 27.0
BJ1342:UTM  15      -  BUICK                                    081 53 19.5
BJ1342
BJ1342|---------------------------------------------------------------------|
BJ1342| PID    Reference Object                     Distance      Geod. Az  |

BJ1342|                                                          dddmmss.s |
BJ1342| BJ1346 BUICK                               APPROX. 0.7 KM 0832004.0 |
BJ1342| BJ4248 MT CARMEL CONVENT CROSS             APPROX. 0.9 KM 1600326.3 |
BJ1342| BJ1344 ALCO RM                                           25738     |
BJ1342|---------------------------------------------------------------------|
BJ1342
BJ1342                         SUPERSEDED SURVEY CONTROL
BJ1342
BJ1342  NAD 83(1992)-  30 01 36.52299(N)    090 06 46.21029(W) AD(       ) B
BJ1342  ELLIP H (12/29/04)  -24.36   (m)                       GP(       ) 4 1
BJ1342  ELLIP H (06/20/00)  -24.36   (m)                       GP(       ) 3 1
BJ1342  ELLIP H (01/21/93)  -24.33   (m)                       GP(       ) 4 2
BJ1342  NAD 83(1992)-  30 01 36.52269(N)    090 06 46.20939(W) AD(       ) A
BJ1342  ELLIP H (09/04/92)  -24.33   (m)                       GP(       ) 3 1
BJ1342  NAD 83(1986)-  30 01 36.53967(N)    090 06 46.20687(W) AD(       ) 1
BJ1342  NAD 83(1986)-  30 01 36.54071(N)    090 06 46.20093(W) AD(       ) 3
BJ1342  NAD 27      -  30 01 35.81240(N)    090 06 45.94411(W) AD(       ) 3
BJ1342  NAVD 88 (12/05/96)    2.008  (m)            6.59   (f) ADJUSTED    1 2
BJ1342  NAVD 88 (02/14/94)    2.002  (m)            6.57   (f) UNKNOWN     1 2
BJ1342  NGVD 29 (05/21/91)    2.061  (m)            6.76   (f) ADJUSTED    1 2
BJ1342
BJ1342.Superseded values are not recommended for survey control.
BJ1342.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BJ1342.See file dsdata.txt to determine how the superseded data were derived.
BJ1342
BJ1342_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYP7844525269(NAD 83)
BJ1342_MARKER: DS = TRIANGULATION STATION DISK
BJ1342_SETTING: 37 = SET IN A MASSIVE RETAINING WALL
BJ1342_SP_SET: SEA WALL
BJ1342_STAMPING: ALCO 1931
BJ1342_MARK LOGO: CGS
BJ1342_PROJECTION: FLUSH
BJ1342_MAGNETIC: N = NO MAGNETIC MATERIAL
BJ1342_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
BJ1342_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
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BJ1342+SATELLITE: SATELLITE OBSERVATIONS - February 20, 2006
BJ1342
BJ1342  HISTORY     - Date     Condition        Report By
BJ1342  HISTORY     - 1931     MONUMENTED       CGS
BJ1342  HISTORY     - 1935     GOOD             LAGS
BJ1342  HISTORY     - 1942     GOOD             CGS
BJ1342  HISTORY     - 1953     GOOD             CGS
BJ1342  HISTORY     - 1954     GOOD             CGS
BJ1342  HISTORY     - 1963     GOOD             CGS
BJ1342  HISTORY     - 1964     GOOD             CGS
BJ1342  HISTORY     - 1981     MARK NOT FOUND   USGS
BJ1342  HISTORY     - 1985     GOOD             USPSQD
BJ1342  HISTORY     - 1985     GOOD             NGS
BJ1342  HISTORY     - 1987     GOOD             LADTD
BJ1342  HISTORY     - 1988     GOOD             USPSQD
BJ1342  HISTORY     - 19880920 GOOD             LADTD
BJ1342  HISTORY     - 19890117 GOOD
BJ1342  HISTORY     - 19901108 GOOD             NGS
BJ1342  HISTORY     - 19911016 GOOD             LADTD
BJ1342  HISTORY     - 19921124 GOOD             NOS
BJ1342  HISTORY     - 19930303 GOOD             NOS
BJ1342  HISTORY     - 19941117 GOOD             NGS
BJ1342  HISTORY     - 19960130 GOOD             NGS
BJ1342  HISTORY     - 19960218 GOOD             NGS
BJ1342  HISTORY     - 19980213 GOOD             NGS
BJ1342  HISTORY     - 19980309 GOOD             NGS
BJ1342  HISTORY     - 20010505 GOOD             NGS
BJ1342  HISTORY     - 20030402 GOOD             3001
BJ1342  HISTORY     - 20040601 GOOD             NGS
BJ1342  HISTORY     - 20040922 GOOD             LADTD
BJ1342  HISTORY     - 20051008 GOOD             NGS
BJ1342  HISTORY     - 20060220 GOOD             3001
BJ1342
BJ1342                          STATION DESCRIPTION
BJ1342
BJ1342'DESCRIBED BY COAST AND GEODETIC SURVEY 1931 (RLS)
BJ1342'NEAR THE WEST END LIGHTHOUSE, ON THE LAKE PONTCHARTRAIN
BJ1342'SEA-WALL IN ZONE 1, WHICH LIES BETWEEN THE ORLEANS CANAL AND THE
BJ1342'NEW BASIN CANAL, AND IN THE 132ND BAY COUNTING FROM THE ORLEANS
BJ1342'CANAL.
BJ1342'
BJ1342'THE STATION IS MARKED BY A STANDARD BRONZE DISK WHICH IS SET
BJ1342'FLUSH WITH THE TOP SURFACE OF THE TOP COPING.
BJ1342'
BJ1342'THE REFERENCE MARK, A STANDARD BRONZE DISK, IS
BJ1342'S 77 DEG 38 MIN E.
BJ1342'
BJ1342'THE CROSS ON THE MOUNT CARMEL CONVENT IS S 19 DEG 56 MIN E.
BJ1342
BJ1342                          STATION RECOVERY (1935)
BJ1342
BJ1342'RECOVERY NOTE BY LOUISIANA GEODETIC SURVEY 1935
BJ1342'STATION RECOVERED AS DESCRIBED.
BJ1342
BJ1342                          STATION RECOVERY (1942)
BJ1342
BJ1342'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1942 (HCW)
BJ1342'STATION WAS RECOVERED AS DESCRIBED IN EVERY DETAIL.  THE
BJ1342'DISTANCES AND DIRECTIONS TO AZIMUTH MARKS WERE NOT CHECKED.
BJ1342'
BJ1342'NEAR THE WEST END LIGHTHOUSE, ON THE LAKE PONTCHARTRAIN
BJ1342'SEA-WALL IN ZONE 1, WHICH LIES BETWEEN THE ORLEANS CANAL AND
BJ1342'THE NEW BASIN CANAL, AND IN THE 132ND BAY COUNTING FROM THE
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BJ1342'ORLEANS CANAL.
BJ1342'
BJ1342'THE STATION IS MARKED BY A STANDARD BRONZE DISK WHICH IS SET
BJ1342'FLUSH WITH THE TOP FURFACE OF THE TOP COPING.
BJ1342'
BJ1342'THE REFERENCE MARK, A STANDARD BRONZE DISK, IS
BJ1342'S 77 DEG 38 MIN E.
BJ1342'
BJ1342'THE CROSS ON THE MOUNT CARMEL CONVENT IS S 19 DEG 56 MIN E.
BJ1342
BJ1342                          STATION RECOVERY (1953)
BJ1342
BJ1342'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1953 (RLE)
BJ1342'STATION AND REFERENCE MARK WERE RECOVERED IN GOOD CONDITION.
BJ1342'A NEW DESCRIPTION FOLLOWS--
BJ1342'
BJ1342'STATION IS LOCATED ON THE LAKE PONTCHARTRAIN SEAWALL, JUST E
BJ1342'OF A U.S. COAST GUARD STATION.  IT IS A STANDARD BRONZE DISK,
BJ1342'STAMPED ALCO 1931 AND CEMENTED IN A DRILL HOLE IN THE TOP OF A
BJ1342'CONCRETE SEAWALL.
BJ1342'
BJ1342'THE REFERENCE MARK IS A STANDARD BRONZE DISK, STAMPED ALCO 1931
BJ1342'AND CEMENTED IN A DRILL HOLE IN THE TOP OF A CONCRETE SEAWALL.
BJ1342'
BJ1342'TO REACH THE STATION FROM THE INTERSECTION OF LAKESHORE DRIVE
BJ1342'AND CANAL BOULEVARD, GO W ON LAKESHORE DRIVE ALONG THE SEAWALL
BJ1342'FOR 0.4 MI. TO THE STATION ON THE RIGHT AS DESCRIBED JUST E OF
BJ1342'THE COAST GUARD STATION.
BJ1342
BJ1342                          STATION RECOVERY (1954)
BJ1342
BJ1342'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1954 (RAE)
BJ1342'THE STATION IS LOCATED IN THE NW SECTION OF NEW ORLEANS, NEAR THE
BJ1342'MOUTH OF NEW CANAL, 150 FT. SE OF NEW CANAL LIGHTHOUSE, AND ON
BJ1342'THE S SHORE OF LAKE PONCHARTRAIN.  IT IS 46 PACES E OF THE W END
BJ1342'OF THE SEAWALL, AND 132 BAYS W OF ORLEANS CANAL.  IT IS A
BJ1342'STANDARD DISK, SET IN A DRILL HOLE IN THE TOP OF THE SEAWALL.  IT
BJ1342'IS STAMPED ALCO 1931.
BJ1342'
BJ1342'THE REFERENCE MARK IS W OF THE STATION S 77 DEG 38 MIN W.
BJ1342'IT IS 13 PACES E OF THE W END OF THE SEAWALL.  IT IS A STANDARD
BJ1342'DISK, SET IN A DRILL HOLE IN THE TOP OF THE SEAWALL, AND STAMPED
BJ1342'ALCO 1931.
BJ1342
BJ1342                          STATION RECOVERY (1963)
BJ1342
BJ1342'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1963
BJ1342'IN NEW ORLEANS.
BJ1342'AT NEW ORLEANS, AT WEST END, NEAR THE NORTH END OF WEST END BOULEVARD,
BJ1342'NEAR THE COAST GUARD STATION, SET IN THE TOP OF THE SEA WALL ALONG
BJ1342'SHORE OF LAKE PONTCHARTRAIN, 112 FEET NORTHWEST OF THE CENTER LINE OF
BJ1342'LAKESHORE DRIVE, 115 FEET EAST OF THE WEST END OF THE SEA WALL, 70
BJ1342'FEET EAST OF A STEEL FENCE CORNER POST ON TOP OF THE SEA WALL AND IS
BJ1342'ABOUT 2 FEET ABOVE THE DRIVE.
BJ1342
BJ1342                          STATION RECOVERY (1964)
BJ1342
BJ1342'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1964 (RRG)
BJ1342'THE STATION AND ONE REFERENCE MARK WAS FOUND AND IN GOOD
BJ1342'CONDITION.
BJ1342'
BJ1342'THE STATION IS LOCATED ALONG THE SEA WALL ALONG THE SHORE OF LAKE
BJ1342'PONTCHARTRAIN, NEAR THE COAST GUARD STATION, 112 FEET NORTHWEST
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BJ1342'OF THE CENTER LINE OF LAKESHORE DRIVE, 115 FEET EAST OF THE WEST
BJ1342'END OF THE SEA WALL, 70 FEET EAST OF A STEEL FENCE POST IN
BJ1342'SEA WALL AND ABOUT 2 FEET ABOVE THE LEVEL OF THE DRIVE.
BJ1342'
BJ1342'THE REFERENCE MARK IS 87 FEET WEST OF THE STATION AND SET ON
BJ1342'TOP OF THE SEA WALL.  23 FEET EAST OF THE WEST END OF THE WALL
BJ1342'AND 2 FEET ABOVE THE LEVEL OF THE DRIVE,
BJ1342
BJ1342                          STATION RECOVERY (1981)
BJ1342
BJ1342'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1981
BJ1342'MARK NOT FOUND.
BJ1342
BJ1342                          STATION RECOVERY (1985)
BJ1342
BJ1342'RECOVERY NOTE BY US POWER SQUADRON 1985 (JCM)
BJ1342'ALCO--1931 FOUND GOOD.
BJ1342'
BJ1342'DESCRIPTION ADEQUATE.
BJ1342'
BJ1342'REFERENCE MARK FOUND GOOD.
BJ1342'LOCATED ON TOP SURFACE OF SEA WALL 87 FEET WEST OF STATION, APPROX.
BJ1342'TWO FEET WEST OF US COAST GUARD DRIVEWAY GATE, UNDER CYCLONE FENCE.
BJ1342
BJ1342                          STATION RECOVERY (1985)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1985
BJ1342'RECOVERED IN GOOD CONDITION, THE 1963 RECOVERY IS ADEQUATE WITH THE
BJ1342'FOLLOWING ADDITION, ADD--7.07 METERS (23.2 FT) NORTH-NORTHEAST OF
BJ1342'STEEL LAMP POST 500.
BJ1342
BJ1342                          STATION RECOVERY (1987)
BJ1342
BJ1342'RECOVERY NOTE BY LA TRANSP AND DEV 1987 (TLH)
BJ1342'THE DESIGNATED MARK WAS RECOVERED WITH CHANGES NOTED BELOW--
BJ1342'A COMPLETE NEW DESCRIPTION WAS MADE THIS DATE.
BJ1342'
BJ1342'THE STATION IS LOCATED ABOUT 7 KM (4.4 MI) NORTH OF INTERSTATE
BJ1342'HIGHWAY 10, NEAR THE U.S. COAST GUARD STATION AT LAKE PONCHATRAIN.
BJ1342'OWNERSHIP--ORLEANS PARISH LEVEE BOARD, SUITE 202, ADMINISTRATION
BJ1342'BUILDING, LAKEFRONT AIRPORT, NEW ORLEANS, LA. PHONE 504-246-4000.
BJ1342'
BJ1342'TO REACH THE STATION FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 AND
BJ1342'CAUSEWAY BOULEVARD, GO NORTH FOR 0.55 KM (0.35 MI) ON CAUSEWAY
BJ1342'BOULEVARD TO VETERANS MEMORIAL HIGHWAY.
BJ1342'TURN RIGHT AND GO EAST FOR 3.89 KM (2.4 MI) ON VETERANS MEMORIAL
BJ1342'BOULEVARD TO PONCHATRAIN BOULEVARD.
BJ1342'TURN LEFT AND GO NORTH FOR 1.85 KM (1.15 MI) ON PONCHATRAIN
BJ1342'BOULEVARD TO ROBERT E LEE BOULEVARD.
BJ1342'CONTINUE STRAIGHT AHEAD AND GO NORTH FOR 0.72 KM (0.45 MI) ON
BJ1342'ROBERT E LEE BOULEVARD TO THE COAST GUARD STATION ENTRANCE ON THE
BJ1342'LEFT AT THE EAST END OF A CURVE IN THE ROAD.  TURN LEFT ONTO A
BJ1342'NARROW LANE FOR 30 METERS (100 FT) TO THE STATION ON THE RIGHT.
BJ1342'
BJ1342'THE STATION IS A STANDARD CGS DISK
BJ1342'STAMPED---ALCO 1931---,
BJ1342'SET INTO A DRILL HOLE IN THE TOP STEP OF THE SEAWALL.
BJ1342'21.2 METERS (69.5 FT) EAST FROM THE EAST GATE POST AT THE ENTRANCE
BJ1342'TO THE COAST GUARD STATION,
BJ1342'7.2 METERS (23.6 FT) NORTHEAST FROM A METAL LIGHT POLE, AND
BJ1342'4.6 METERS (15.1 FT) WEST FROM A SEAM IN THE SEAWALL.
BJ1342
BJ1342                          STATION RECOVERY (1988)
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BJ1342
BJ1342'RECOVERY NOTE BY US POWER SQUADRON 1988 (WFT)
BJ1342'RECOVERED IN GOOD CONDITION.
BJ1342
BJ1342                          STATION RECOVERY (1988)
BJ1342
BJ1342'RECOVERY NOTE BY LA TRANSP AND DEV 1988
BJ1342'THE STATION IS LOCATED ABOUT 7 KM (4.35 MI) NORTH OF INTERSTATE
BJ1342'HIGHWAY 10, NEAR THE U.S. COAST GUARD STATION AT LAKE PONTCHATRAIN.
BJ1342'OWNERSHIP--ORLEANS PARISH LEVEE BOARD, SUITE 202, ADMINISTRATION
BJ1342'BUILDING, LAKEFRONT AIRPORT, NEW ORLEANS, LA.  PHONE 504-246-4000.
BJ1342'TO REACH THE STATION FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 AND
BJ1342'CAUSEWAY BOULEVARD, GO NORTH FOR 0.55 KM (0.35 MI) ON CAUSEWAY
BJ1342'BOULEVARD TO VETERANS MEMORIAL HIGHWAY, TURN RIGHT AND GO EAST FOR
BJ1342'3.89 KM (2.40 MI) ON VETERANS MEMORIAL BOULEVARD TO WEST END BLVD,
BJ1342'TURN LEFT AND GO NORTH ON WEST END BLVD FOR 2.57 KM (1.60 MI) TO THE
BJ1342'COAST GUARD STATION ENTRANCE ON THE LEFT AT THE EAST END OF A CURVE IN
BJ1342'THE ROAD.  TURN LEFT ONTO A NARROW LANE FOR 30 METERS (98.4 FT) TO THE
BJ1342'STATION ON THE RIGHT, 21.2 M (69.6 FT) EAST FROM THE EAST GATE POST AT
BJ1342'THE ENTRANCE TO THE COAST GUARD STATION, 7.2 M (23.6 FT) NORTHEAST
BJ1342'FROM A METAL LIGHT POLE, AND 4.6 M (15.1 FT) WEST FROM A SEAM IN THE
BJ1342'SEAWALL.
BJ1342
BJ1342                          STATION RECOVERY (1989)
BJ1342
BJ1342'RECOVERED 1989
BJ1342'RECOVERED IN GOOD CONDITION.
BJ1342
BJ1342                          STATION RECOVERY (1990)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
BJ1342'IN NEW ORLEANS, AT 800 LAKESHORE DRIVE, IN A CONCRETE RETAINING WALL
BJ1342'ALONG THE SOUTH SHORE OF LAKE PONTCHARTRAIN, 38.8 M (127.3 FT)
BJ1342'EAST-SOUTHEAST OF THE SOUTHEAST CORNER OF A LIGHTHOUSE AT 800
BJ1342'LAKESHORE DRIVE, 35.0 M (114.8 FT) EAST OF THE WEST END OF THE
BJ1342'RETAINING WALL, 34.1 M (111.9 FT) NORTHWEST OF THE CENTERLINE OF THE
BJ1342'DRIVE, 23.9 M (78.4 FT) EAST OF THE CENTER OF A DRIVEWAY, 21.3 M
BJ1342'(69.9 FT) EAST OF A STEEL FENCE CORNER POST ON TOP OF THE SEA WALL,
BJ1342'7.1 M (23.3 FT) NORTH-NORTHEAST OF UTILITY LIGHT POLE NUMBER 500, AND
BJ1342'0.6 M (2.0 FT) ABOVE THE LEVEL OF THE DRIVE.
BJ1342
BJ1342                          STATION RECOVERY (1991)
BJ1342
BJ1342'RECOVERY NOTE BY LA TRANSP AND DEV 1991
BJ1342'THE STATION IS LOCATED IN NORTHWEST NEW ORLEANS, NEAR THE U.S. COAST
BJ1342'GUARD STATION ON THE SOUTH SHORE OF LAKE PONCHATRAIN.
BJ1342'OWNERSHIP--ORLEANS PARISH LEVEE BOARD, SUITE 202, ADMINISTRATION
BJ1342'BUILDING, LAKEFRONT AIRPORT, NEW ORLEANS, LA. PHONE 504-246-4000.
BJ1342'TO REACH THE STATION FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 AND
BJ1342'CAUSEWAY BOULEVARD, GO NORTH FOR 0.35 MI (0.56 KM) ON CAUSEWAY
BJ1342'BOULEVARD TO THE JUNCTION WITH VETERANS MEMORIAL BOULVARD, TURN RIGHT
BJ1342'AND GO EAST FOR 2.4 MI (3.9 KM) ON VETERANS BOULEVARD TO THE JUNCTION
BJ1342'WITH WEST END BOULEVARD, TURN LEFT AND GO NORTH FOR 1.6 MI (2.6 KM)
BJ1342'ON WEST END BOULEVARD WHICH TURNS INTO LAKESHORE DRIVE TO THE COAST
BJ1342'GUARD STATION ON THE LEFT AND STATION MARK ON THE LEFT SET IN THE
BJ1342'SEAWALL.
BJ1342'THE STATION IS 123.0 FT (37.5 M) NORTH-NORTHWEST FROM THE CENTER OF
BJ1342'LAKESHORE DRIVE,  69.5 FT (21.2 M) EAST-NORTHEAST FROM THE EAST GATE
BJ1342'POST AT THE ENTRANCE OF THE COAST GUARD STATION, 23.5 FT (7.2 M)
BJ1342'NORTHEAST FROM A METAL LIGHT POLE, 32.5 FT (9.9 M) NORTH FROM THE
BJ1342'CENTER OF THE DRIVE INTO THE COAST GUARD STATION, 15.0 FT (4.6 M)
BJ1342'WEST-SOUTHWEST FROM A SEAM IN THE SEA WALL, FLUSH WITH THE TOP OF THE
BJ1342'SEAWALL AND ABOUT LEVEL WITH THE ROAD.
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BJ1342
BJ1342                          STATION RECOVERY (1992)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL OCEAN SERVICE 1992
BJ1342'RECOVERED IN GOOD CONDITION.
BJ1342
BJ1342                          STATION RECOVERY (1993)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL OCEAN SERVICE 1993
BJ1342'RECOVERED IN GOOD CONDITION.
BJ1342
BJ1342                          STATION RECOVERY (1994)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
BJ1342'IN NEW ORLEANS, AT 8001 LAKESHORE DRIVE, IN A CONCRETE RETAINING WALL
BJ1342'ALONG THE SOUTH SHORE OF LAKE PONTCHARTRAIN, 36.7 M (120.4 FT)
BJ1342'SOUTHEAST OF THE SOUTHEAST CORNER OF THE U.S. COAST GUARD LIGHT HOUSE
BJ1342'AT 8001 LAKESHORE DRIVE, 27.3 M (89.6 FT) EAST OF ALCO REFERENCE MARK,
BJ1342'9.9 M (32.5 FT) NORTH-NORTHEAST OF AND LEVEL WITH THE CENTER OF THE
BJ1342'LIGHTHOUSE ENTRANCE DRIVE, AND 7.2 M (23.6 FT) NORTHEAST OF A UTILITY
BJ1342'LIGHT POLE.
BJ1342
BJ1342                          STATION RECOVERY (1996)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (RPB)
BJ1342'RECOVERED AS DESCRIBED.
BJ1342
BJ1342                          STATION RECOVERY (1996)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (RPB)
BJ1342'RECOVERED AS DESCRIBED.
BJ1342
BJ1342                          STATION RECOVERY (1998)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (CSM)
BJ1342'RECOVERED AS DESCRIBED.
BJ1342
BJ1342                          STATION RECOVERY (1998)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (CSM)
BJ1342'RECOVERED AS DESCRIBED.
BJ1342
BJ1342                          STATION RECOVERY (2001)
BJ1342
BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2001 (RTN)
BJ1342'THIS STATION IS LOCATED IN NORTH NEW ORLEANS, LOUISIANA.  IN A
BJ1342'CONCRETE
BJ1342'RETAINING WALL ALONG THE SOUTH SHORE OF LAKE PONTCHARTRAIN.
BJ1342'OWNERSHIP IS THE ORLEANS PARISH LEVEE BOARD, SUITE 202, ADMINISTRATION
BJ1342'BUILDING, LAKEFRONT AIRPORT, STARS AND STRIPES BOULEVARD, NEW ORLEANS,
BJ1342'LA. PHONE  504 246-4000.
BJ1342'
BJ1342'TO REACH THIS STATION FROM THE JUNCTION OF INTERSTATE 10 AND CAUSEWAY
BJ1342'BOULEVARD, GO NORTH FOR 0.35 MILES ON CAUSEWAY BOULEVARD TO THE
BJ1342'JUNCTION WITH VETERANS BOULEVARD.  RIGHT AND GO EAST FOR 2.4 MILES ON
BJ1342'VETERANS BOULEVARD TO THE JUNCTION WITH WEST END BOULEVARD, TURN
BJ1342'LEFT AND GO NORTH FOR 1.6 MILES ON WEST END BOULEVARD WHICH TURNS INTO
BJ1342'LAKESHORE DRIVE TO THE COAST GUARD
BJ1342'
BJ1342'STATION ON LEFT AND STATION ON THE LEFT. .   STATION IS SET IN THE
BJ1342'SEAWALL.  IT
BJ1342'IS 217.0 FEET NORTH-NORTHWEST FROM THE CENTER OF LAKESHORE DRIVE, 69.5
BJ1342'FEET EAST-NORTHEAST FROM TH EAST GATE POST AT THE ENTRANCE OF THE
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 BJ1342'COAST GUARD STATION, 23.5 FEET NORTH FROM THE CENTER OF THE DRIVE INTO
 BJ1342'COAST GUARD STATION, 15.0 FEET WEST-SOUTHWEST FROM THE SEAM IN THE SEA
 BJ1342'WALL, 89.6 FEET EAST OF ALCO REFERENCE MARK, 23.6 FEET NORTHEAST OF A
 BJ1342'UTILITY LIGHT POLE, AND FLUSH WITH TOP OF THE SEAWALL AND ABOUT LEVEL
 BJ1342'WITH ROAD.
 BJ1342'
 BJ1342'
 BJ1342
 BJ1342                          STATION RECOVERY (2003)
 BJ1342
 BJ1342'RECOVERY NOTE BY 3001, INC 2003 (KD)
 BJ1342'THE STATION IS LOCATED IN NEW ORLEANS ON A SEA WALL BESIDE JOES
 BJ1342'RESTURANT AT THE LAKE  SHORE. ITI IS NEXT TO A GREEN AND WHITE LIGHT
 BJ1342'HOUSE. THE STATION IS 3.8 MILES FROM METAIRIE,  8.0 MILES FROM KENNER,
 BJ1342'AND 10.7 MILES FROM CHALMETTE.
 BJ1342'
 BJ1342'OWNERSHIP- UNKNOWN
 BJ1342'
 BJ1342'TO REACH THE STATION FROM THE INTERSECTION OF I-10 AND I-610 DRIVE
 BJ1342'NORTH ON WEST END  BLVD. FOR 1.7 MILES. THE ROAD BECOMES LAKE FRONT
 BJ1342'DRIVE. KEEP GOING FOR 0.4 MILES TO A  CURVE IN THE ROAD. TURN INTO
 BJ1342'JOE'S RESTURANT PARKING LOT ON THE LEFT SIDE OF THE ROAD.  THE STATION
 BJ1342'IS LOCATED NORTH OF THE PARKING AREA IN THE SEAWALL.
 BJ1342'
 BJ1342'THE STATION IS A TRIANGULATION STATION DISK SET FLUSH IN A SEAWALL. IT
 BJ1342'IS LOCATED 68.7 FT.  EAST FROM THE CORNER OF THE SEAWALL, 23.5 FT.
 BJ1342'NORTHEAST FROM A LIGHT POLE, AND 54 FEET  NORTHWEST OF A STORM DRAIN.
 BJ1342
 BJ1342                          STATION RECOVERY (2004)
 BJ1342
 BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
 BJ1342'RECOVERED AS DESCRIBED.
 BJ1342
 BJ1342                          STATION RECOVERY (2004)
 BJ1342
 BJ1342'RECOVERY NOTE BY LA TRANSP AND DEV 2004 (SLC)
 BJ1342'RECOVERED IN GOOD CONDITION.
 BJ1342
 BJ1342                          STATION RECOVERY (2005)
 BJ1342
 BJ1342'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2005 (KLF)
 BJ1342'RECOVERED AS DESCRIBED.
 BJ1342
 BJ1342                          STATION RECOVERY (2006)
 BJ1342
 BJ1342'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 BJ1342'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH0901 ***********************************************************************
 BH0901  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH0901  DESIGNATION -  B 31 USE
 BH0901  PID         -  BH0901
 BH0901  STATE/COUNTY-  MS/HARRISON
 BH0901  USGS QUAD   -  PASS CHRISTIAN (1994)
 BH0901
 BH0901                         *CURRENT SURVEY CONTROL
 BH0901  ___________________________________________________________________
 BH0901* NAD 83(1993)-  30 20 15.35294(N)    089 10 11.52293(W)     ADJUSTED
 BH0901* NAVD 88     -         3.16 **(meters)      10.4  **(feet)  GPS OBS(2004.65)
 BH0901  **This station is located in a subsidence area (see below).
 BH0901  ___________________________________________________________________
 BH0901  EPOCH DATE  -        2004.65
 BH0901  X           -      79,820.802 (meters)                     COMP
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BH0901  Y           -  -5,508,849.443 (meters)                     COMP
BH0901  Z           -   3,202,716.547 (meters)                     COMP
BH0901  LAPLACE CORR-          -1.35  (seconds)                    DEFLEC99
BH0901  ELLIP HEIGHT-         -24.68  (meters)         (04/11/06) GPS OBS
BH0901  GEOID HEIGHT-         -27.86  (meters)                     GEOID03
BH0901  DYNAMIC HT  -           3.16  (meters)      10.4   (feet)  COMP
BH0901  MODELED GRAV-     979,317.1   (mgal)                       NAVD 88
BH0901
BH0901  HORZ ORDER  -  B
BH0901  VERT ORDER  -  FIRST     CLASS I (See Below)
BH0901  ELLP ORDER  -  FOURTH    CLASS II
BH0901
BH0901.The horizontal coordinates were established by GPS observations
BH0901.and adjusted by the National Geodetic Survey in April 2006..
BH0901.The horizontal coordinates are valid at the epoch date displayed above.
BH0901.The epoch date for horizontal control is a decimal equivalence
BH0901.of Year/Month/Day.
BH0901
BH0901 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH0901 ** and geoid heights are valid at the date of observation. These heights
BH0901 ** must always be validated when used as control.
BH0901 ** The orthometric height was determined by GPS observations using
BH0901 ** precise GPS observation and processing techniques and a new
BH0901 ** realization of GEOID03. It supersedes the leveled height previously
BH0901 ** determined for this station.
BH0901 ** The geoid height was determined by a new realization of GEOID03 for the
BH0901 ** epoch indicated which incorporates improved geoid heights for the
BH0901 ** Southern Louisiana Subsidence area.
BH0901 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH0901.The orthometric height was determined by GPS observations and a
BH0901.high-resolution geoid model using precise GPS observation and
BH0901.processing techniques. It supersedes the leveled height previously
BH0901.determined for this station.
BH0901.The vertical order pertains to the first NAVD 88 superseded value.
BH0901
BH0901.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH0901
BH0901.The Laplace correction was computed from DEFLEC99 derived deflections.
BH0901
BH0901.The ellipsoidal height was determined by GPS observations
BH0901.and is referenced to NAD 83.
BH0901
BH0901.The geoid height was determined by GEOID03.
BH0901
BH0901.The dynamic height is computed by dividing the NAVD 88
BH0901.geopotential number by the normal gravity value computed on the
BH0901.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH0901.degrees latitude (g = 980.6199 gals.).
BH0901
BH0901.The modeled gravity was interpolated from observed gravity values.
BH0901
BH0901;                    North         East     Units Scale Factor Converg.
BH0901;SPC MS E     -    92,892.010   267,641.067   MT  0.99996291   -0 10 11.9
BH0901;SPC MS E     -   304,763.20    878,085.73   sFT  0.99996291   -0 10 11.9
BH0901;UTM  16      - 3,358,190.541   291,408.687   MT  1.00013681   -1 05 47.0
BH0901
BH0901!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH0901!SPC MS E     -   1.00000388  x   0.99996291  =   0.99996679
BH0901!UTM  16      -   1.00000388  x   1.00013681  =   1.00014069
BH0901
BH0901                          SUPERSEDED SURVEY CONTROL
BH0901
BH0901  NAVD 88 (06/15/91)    3.178  (m)           10.43   (f) ADJUSTED    1 1
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 BH0901  NGVD 29 (??/??/??)    3.139  (m)          10.30   (f) ADJUSTED    1 1
 BH0901
 BH0901.Superseded values are not recommended for survey control.
 BH0901.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 BH0901.See file dsdata.txt to determine how the superseded data were derived.
 BH0901
 BH0901_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU9140958191(NAD 83)
 BH0901_MARKER: DD = SURVEY DISK
 BH0901_SETTING: 36 = SET IN A MASSIVE STRUCTURE
 BH0901_SP_SET: SET IN A MASSIVE STRUCTURE
 BH0901_STAMPING: B 31 1958
 BH0901_MAGNETIC: N = NO MAGNETIC MATERIAL
 BH0901_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 BH0901
 BH0901  HISTORY     - Date     Condition        Report By
 BH0901  HISTORY     - 1958     MONUMENTED       USE
 BH0901  HISTORY     - 1968     GOOD             CGS
 BH0901  HISTORY     - 1976     GOOD             NGS
 BH0901  HISTORY     - 19880823 GOOD             USPSQD
 BH0901  HISTORY     - 20060306 GOOD             3001
 BH0901
 BH0901                          STATION DESCRIPTION
 BH0901
 BH0901'DESCRIBED BY COAST AND GEODETIC SURVEY 1968
 BH0901'1.7 MI SW FROM LONG BEACH.
 BH0901'ABOUT 1.2 MILES SOUTHWEST ALONG THE LOUISVILLE AND NASHVILLE RAILROAD
 BH0901'FROM THE CROSSING OF JEFF DAVIS AVENUE AT LONG BEACH, THENCE 0.5 MILE
 BH0901'SOUTH ALONG LANG AVENUE, 217 FEET NORTHEAST OF THE EXTENDED CENTER
 BH0901'LINE OF LANG AVENUE, SET ON THE TOP OF THE CONCRETE SEA WALL NEAR THE
 BH0901'EAST CORNER OF A CONCRETE CULVERT UNDER U. S. HIGHWAY 90, 16.2 FEET
 BH0901'SOUTHEAST OF THE SOUTHEAST CURB OF THE EASTBOUND LANE OF THE HIGHWAY,
 BH0901'2.9 FEET NORTHEAST OF THE SOUTHWEST END OF THE SEA WALL AND 2 1/2 FEET
 BH0901'ABOVE THE LEVEL OF THE HIGHWAY.
 BH0901
 BH0901                          STATION RECOVERY (1976)
 BH0901
 BH0901'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1976
 BH0901'RECOVERED IN GOOD CONDITION.
 BH0901
 BH0901                          STATION RECOVERY (1988)
 BH0901
 BH0901'RECOVERY NOTE BY US POWER SQUADRON 1988 (WCE)
 BH0901'RECOVERED IN GOOD CONDITION.
 BH0901
 BH0901                          STATION RECOVERY (2006)
 BH0901
 BH0901'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 BH0901'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH0984 ***********************************************************************
 BH0984  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH0984  DESIGNATION -  BROWN 2
 BH0984  PID         -  BH0984
 BH0984  STATE/COUNTY-  MS/HANCOCK
 BH0984  USGS QUAD   -  WAVELAND (1976)
 BH0984
 BH0984                         *CURRENT SURVEY CONTROL
 BH0984  ___________________________________________________________________
 BH0984* NAD 83(1993)-  30 18 07.45682(N)    089 29 47.18326(W)     ADJUSTED
 BH0984* NAVD 88     -         5.42 **(meters)      17.8  **(feet)  GPS OBS(2004.65)
 BH0984  **This station is located in a subsidence area (see below).
 BH0984  ___________________________________________________________________
 BH0984  EPOCH DATE  -        2004.65
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BH0984  X           -      48,438.040 (meters)                    COMP
BH0984  Y           -  -5,511,205.569 (meters)                    COMP
BH0984  Z           -   3,199,318.313 (meters)                    COMP
BH0984  LAPLACE CORR-          -2.07  (seconds)                   DEFLEC99
BH0984  ELLIP HEIGHT-         -21.76  (meters)         (04/11/06) GPS OBS
BH0984  GEOID HEIGHT-         -27.19  (meters)                    GEOID03
BH0984  DYNAMIC HT  -           5.42  (meters)      17.8   (feet)  COMP
BH0984  MODELED GRAV-     979,335.6   (mgal)                      NAVD 88
BH0984
BH0984  HORZ ORDER  -  B
BH0984  VERT ORDER  -  FIRST     CLASS I (See Below)
BH0984  ELLP ORDER  -  FOURTH    CLASS II
BH0984
BH0984.The horizontal coordinates were established by GPS observations
BH0984.and adjusted by the National Geodetic Survey in April 2006..
BH0984.The horizontal coordinates are valid at the epoch date displayed above.
BH0984.The epoch date for horizontal control is a decimal equivalence
BH0984.of Year/Month/Day.
BH0984
BH0984 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH0984 ** and geoid heights are valid at the date of observation. These heights
BH0984 ** must always be validated when used as control.
BH0984 ** The orthometric height was determined by GPS observations using
BH0984 ** precise GPS observation and processing techniques and a new
BH0984 ** realization of GEOID03. It supersedes the leveled height previously
BH0984 ** determined for this station.
BH0984 ** The geoid height was determined by a new realization of GEOID03 for the
BH0984 ** epoch indicated which incorporates improved geoid heights for the
BH0984 ** Southern Louisiana Subsidence area.
BH0984 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH0984.The orthometric height was determined by GPS observations and a
BH0984.high-resolution geoid model using precise GPS observation and
BH0984.processing techniques. It supersedes the leveled height previously
BH0984.determined for this station.
BH0984.The vertical order pertains to the first NAVD 88 superseded value.
BH0984
BH0984.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH0984
BH0984.The Laplace correction was computed from DEFLEC99 derived deflections.
BH0984
BH0984.The ellipsoidal height was determined by GPS observations
BH0984.and is referenced to NAD 83.
BH0984
BH0984.The geoid height was determined by GEOID03.
BH0984
BH0984.The dynamic height is computed by dividing the NAVD 88
BH0984.geopotential number by the normal gravity value computed on the
BH0984.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH0984.degrees latitude (g = 980.6199 gals.).
BH0984
BH0984.The modeled gravity was interpolated from observed gravity values.
BH0984
BH0984;                     North         East     Units Scale Factor Converg.
BH0984;SPC MS E     -    89,092.028   236,216.467   MT  1.00000017   -0 20 04.5
BH0984;SPC MS E     -   292,296.10    774,986.86   sFT  1.00000017   -0 20 04.5
BH0984;SPC LA S     -   201,166.325 1,176,677.541   MT  0.99993951   +0 55 06.5
BH0984;SPC LA S     -   659,993.18  3,860,482.90   sFT  0.99993951   +0 55 06.5
BH0984;UTM  16      - 3,354,898.116   259,919.147   MT  1.00031114   -1 15 36.7
BH0984
BH0984!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH0984!SPC MS E     -   1.00000342  x   1.00000017  =   1.00000359
BH0984!SPC LA S     -   1.00000342  x   0.99993951  =   0.99994293
BH0984!UTM  16      -   1.00000342  x   1.00031114  =   1.00031456
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BH0984
BH0984:                  Primary Azimuth Mark                          Grid Az
BH0984:SPC MS E     -  BROWN RM 2                                      269 18 00.0
BH0984:SPC LA S     -  BROWN RM 2                                      268 02 49.0
BH0984:UTM  16      -  BROWN RM 2                                      270 13 32.2
BH0984
BH0984|---------------------------------------------------------------------|
BH0984| PID    Reference Object                     Distance      Geod. Az  |
BH0984|                                                            dddmmss.s |
BH0984| BH0983 BROWN 2 RM 4                          12.202 METERS 09239      |
BH0984| BH2725 BROWN                                 52.181 METERS 18543      |
BH0984| BH0986 BROWN RM 2                                          2685755.5 |
BH0984| BH0985 BROWN RM 5                            26.043 METERS 27240      |
BH0984|---------------------------------------------------------------------|
BH0984
BH0984                          SUPERSEDED SURVEY CONTROL
BH0984
BH0984  NAD 83(1993)-  30 18 07.45905(N)    089 29 47.18106(W) AD(       ) 2
BH0984  NAD 83(1986)-  30 18 07.47239(N)    089 29 47.17571(W) AD(       ) 2
BH0984  NAD 27      -  30 18 06.77100(N)    089 29 46.98600(W) AD(       ) 2
BH0984  NAVD 88 (02/14/94)    5.466  (m)           17.93   (f) ADJUSTED    1 1
BH0984  NAVD 88 (06/15/91)    5.465  (m)           17.93   (f) UNKNOWN     1 1
BH0984  NGVD 29 (??/??/??)    5.421  (m)           17.79   (f) ADJUSTED    1 1
BH0984
BH0984.Superseded values are not recommended for survey control.
BH0984.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH0984.See file dsdata.txt to determine how the superseded data were derived.
BH0984
BH0984_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU5991954898(NAD 83)
BH0984_MARKER: DS = TRIANGULATION STATION DISK
BH0984_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
BH0984_SP_SET: CONCRETE POST
BH0984_STAMPING: BROWN 2 1965
BH0984_MARK LOGO: CGS
BH0984_MAGNETIC: N = NO MAGNETIC MATERIAL
BH0984_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
BH0984+STABILITY: SURFACE MOTION
BH0984_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH0984+SATELLITE: SATELLITE OBSERVATIONS - March 06, 2006
BH0984
BH0984  HISTORY     - Date     Condition        Report By
BH0984  HISTORY     - 1965     MONUMENTED       CGS
BH0984  HISTORY     - 1969     GOOD             CGS
BH0984  HISTORY     - 1969     GOOD             CGS
BH0984  HISTORY     - 1972     GOOD             MSHD
BH0984  HISTORY     - 1972     GOOD             MSHD
BH0984  HISTORY     - 1974     GOOD             NGS
BH0984  HISTORY     - 1976     GOOD             NGS
BH0984  HISTORY     - 19930318 GOOD             NGS
BH0984  HISTORY     - 20060306 GOOD             3001
BH0984
BH0984                          STATION DESCRIPTION
BH0984
BH0984'DESCRIBED BY COAST AND GEODETIC SURVEY 1965 (AKH)
BH0984'THE STATION IS LOCATED ABOUT 9 MILES WEST OF BAY ST. LOUIS AT THE
BH0984'FORKS FORMED BY THE JUNCTION OF U.S. HIGHWAY 90 AND THE STATE
BH0984'HIGHWAY 43, 0.15 MILES EAST OF THE FORKS, 76 FEET NORTH OF THE
BH0984'CENTERLINE OF U.S. HIGHWAY 90, 25 FEET NORTH OF A POWER LINE, 117
BH0984'FEET EAST OF POWER POLE NO. 91, 2 FEET EAST NORTHEAST OF A METAL
BH0984'WITNESS POST.  IT IS A STANDARD DISK STAMPED BROWN 2 1965.
BH0984'PROJECTS 4-INCHES.
BH0984'
BH0984'REFERENCE MARK NO. 4 IS 40.03 FEET EAST OF THE STATION, 76 FEET NORTH
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BH0984'OF THE CENTER OF THE ROAD, 157 FEET EAST OF A POWER POLE NO. 91,
BH0984'25 FEET NORTH OF A POWER POLE.  IT IS A STANDARD DISK STAMPED BROWN 2
BH0984'NO. 4 1965 SET IN THE TOP OF RIGHT-OF-WAY MARKER, PROJECTING
BH0984'8-INCHES.
BH0984'
BH0984'REFERENCE MARK NO. 5 IS 85.44 FEET WEST OF THE STATION, 76 FEET NORTH
BH0984'OF THE CENTERLINE OF U.S. HIGHWAY 90, 25 FEET NORTH OF A POWER
BH0984'POLE, 41 FEET NORTHEAST OF POWER POLE NO. 91, 2 FEET NORTHEAST OF A
BH0984'METAL WITNESS POST.  IT IS A STANDARD DISK STAMPED BROWN 2 NO.
BH0984'5 1965. PROJECTS 4-INCHES.
BH0984'
BH0984'REFERENCE MARK NO. 2 (AZIMUTH MARK) IS ABOUT 750 FEET WEST OF THE
BH0984'STATION, 0.1 MILE WEST OF THE JUNCTION OF U.S. HIGHWAY 90 AND STATE
BH0984'HIGHWAY 43.  SET IN TOP OF CENTER OF NORTH HEADWALL OF A 15-INCH
BH0984'CONCRETE CULVERT UNDER HIGHWAY.
BH0984'
BH0984'TO REACH THE STATION FROM THE POST OFFICE IN BAY ST. LOUIS, GO NORTH
BH0984'ON MAIN STREET TO U.S. HIGHWAY 90, TURN LEFT (WEST) AND GO 9.5 MILES
BH0984'TO MARK ON THE RIGHT, CONTINUE WEST FOR 0.15 MILE TO REFERENCE MARK
BH0984'NO. 2 ON THE RIGHT.
BH0984
BH0984                          STATION RECOVERY (1969)
BH0984
BH0984'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1969 (RRG)
BH0984'THE STATION, RM 2, 4 AND 5 WERE ALL RECOVERED AND IN GOOD
BH0984'CONDITION.  THE STATION MAY BE REACHED BY GOING 8.3 MILES
BH0984'NORTHEAST ALONG U.S. HIGHWAY 90 FROM THE EAST END OF THE BRIDGE
BH0984'OVER THE PEARL RIVER AT PEARLINGTON, IN SECTION 33, R 15 W, T 8 S,
BH0984'75.5 FEET NORTH OF THE CENTER LINE OF THE PRESENT HIGHWAY, 119
BH0984'FEET NORTHEAST OF POWER LINE POLE NO. 91, 2 FEET NORTHEAST OF A
BH0984'METAL WITNESS POST, 1 FOOT BELOW THE LEVEL OF THE HIGHWAY AND
BH0984'SET IN THE TOP OF A CONCRETE POST PROJECTING 1 INCH ABOVE THE
BH0984'LEVEL OF THE GROUND.
BH0984'
BH0984'RM 2 IS ABOUT 0.2 MILE SOUTHWEST OF THE STATION, ALONG STATE
BH0984'HIGHWAY 607, SET ON THE TOP AND NEAR THE CENTER OF THE NORTH
BH0984'CONCRETE HEAD WALL FOR A 15-INCH PIPE CULVERT UNDER THE STATE
BH0984'HIGHWAY, 15.5 FEET NORTH OF THE CENTER LINE OF THE STATE HIGHWAY
BH0984'AND ABOUT LEVEL WITH THE HIGHWAY.
BH0984'
BH0984'RM 4 IS 40.0 FEET EAST OF THE STATION MARK, 75 FEET NORTH OF THE
BH0984'CENTER LINE OF THE HIGHWAY, 2 FEET NORTHEAST OF A METAL WITNESS
BH0984'POST, SET IN THE TOP OF A CONCRETE POST PROJECTING 12 INCHES ABOVE
BH0984'THE LEVEL OF THE GROUND AND ABOUT LEVEL WITH THE HIGHWAY.
BH0984'
BH0984'RM 5 IS 85.0 FEET WEST OF THE STATION MARK, 77 FEET NORTH OF THE
BH0984'CENTER LINE OF THE HIGHWAY, 2 FEET EAST OF A METAL WITNESS POST,
BH0984'42 FEET NORTHEAST OF POWER LINE POLE 91, 1 FOOT BELOW THE LEVEL
BH0984'OF THE HIGHWAY AND SET IN THE TOP OF A CONCRETE POST PROJECTING
BH0984'2 INCHES ABOVE THE LEVEL OF THE GROUND.
BH0984'
BH0984'NOTE--
BH0984'
BH0984'THE STATION MARK IS STAMPED BROWN 2 1965
BH0984'
BH0984'RM 2 IS STAMPED BROWN NO 2 1931
BH0984'
BH0984'RM 4 IS STAMPED BROWN 2 NO 4 1965
BH0984'
BH0984'RM 5 IS STAMPED BROWN NO 5 1965.
BH0984'
BH0984'AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN
BH0984'8.3 MILES NORTHEAST OF PEARLINGTON.
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BH0984
BH0984                          STATION RECOVERY (1969)
BH0984
BH0984'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1969 (WHS)
BH0984'STATION MARK AND REFERENCE MARKS NO. 4 AND NO. 5 RECOVERED IN
BH0984'GOOD CONDITION.  THE AZIMUTH MARK WAS NOT FOUND AND IS BELIEVED
BH0984'TO HAVE BEEN DESTROYED BY ROAD CONSTRUCTION.
BH0984'
BH0984'THE ORIGINAL DESCRIPTION IS ADEQUATE WITH THE FOLLOWING
BH0984'CORRECTIONS--
BH0984'
BH0984'1.  STATE HIGHWAY 43 HAS BEEN RENUMBERED AND IS NOW STATE
BH0984'HIGHWAY 607.
BH0984'
BH0984'2.  REFERENCES TO POWER LINES AND POWER POLE ARE NOT USEFUL AS THE
BH0984'POWER LINE NO LONGER EXISTS.
BH0984
BH0984                          STATION RECOVERY (1972)
BH0984
BH0984'RECOVERY NOTE BY MISSISSIPPI STATE HIGHWAY DEPARTMENT 1972 (RLW)
BH0984'THE STATION WAS VISITED 3-24-72 AND THE STATION MARK RM NO 2
BH0984'(AZIMUTH MARK) WAS REPORTED DESTROYED BY A PREVIOUS DESCRIPTION.
BH0984'
BH0984'THE STATION IS LOCATED 7.8 MILES NORTHEAST OF PEARLINGTON ON
BH0984'THE NORTH ROW OF U.S. HIGHWAY 90, 9.6 MILES WEST OF BAY ST. LOUIS,
BH0984'0.4 MILES EAST OF THE JUNCTION OF U.S. HIGHWAY 90 AND STATE HIGHWAY
BH0984'607 IN THE SOUTHEAST 1/4 OF SECTION 33, T 8S, R 15W.
BH0984'
BH0984'IT IS 75.5 FEET NORTH OF THE NORTH LANE OF HIGHWAY 90, 108 FEET
BH0984'WEST OF THE SOUTH POST OF A LARGE SIGN, 105 FEET EAST OF A POWER
BH0984'POLE WITH A GUY WIRE WHERE THE LINE ENDS, 1.5 FEET NORTHWEST OF
BH0984'A METAL WITNESS POST AND 49.5 FEET NORTHWEST OF THE NORTH POST OF
BH0984'THE PEARLINGTON NEXT LEFT SIGN.
BH0984'
BH0984'IT IS A TRIANGULATION DISK, STAMPED BROWN 2 1965 PROJECTING 4
BH0984'INCHES.
BH0984'
BH0984'REFERENCE MARK NO 4 IS 40.03 FEET EAST OF THE STATION.  IT IS
BH0984'75 FEET NORTH OF THE CENTER OF THE NORTH LANE OF U.S. HIGHWAY 90,
BH0984'68 FEET WEST OF THE SOUTH POST OF A LARGE SIGN, 44 FEET NORTHEAST
BH0984'OF THE NORTH POST OF THE PEARLINGTON NEXT LEFT SIGN, 1.5 FEET
BH0984'EAST OF A METAL WITNESS POST SET IN THE TOP OF A ROW MARKER
BH0984'PROJECTING 12 INCHES.  IT IS A REFERENCE MARK DISK, STAMPED
BH0984'BROWN 2 NO 4 1965.
BH0984'
BH0984'REFERENCE MARK NO 5 IS 88.44 FEET WEST OF THE STATION.  IT IS 76
BH0984'FEET EAST OF THE CENTER OF THE NORTH LANE OF U.S. HIGHWAY 90,
BH0984'19.5 FEET EAST OF A POWER POLE WITH A GUY WIRE, 22 FEET SOUTHEAST
BH0984'OF THE SOUTH POST OF THE EAST ONE OF TWO SIGNS AND 1.5 FEET
BH0984'NORTHEAST OF A METAL WITNESS POST.  IT IS A REFERENCE MARK DISK,
BH0984'STAMPED BROWN NO 5 1965 PROJECTING 4 INCHES.
BH0984'
BH0984'TO REACH THE STATION FROM THE WEST END OF THE BRIDGE OVER
BH0984'ST. LOUIS BAY AT BAY ST. LOUIS GO WEST ON U.S. HIGHWAY 90 FOR
BH0984'3.5 MILES TO THE JUNCTION OF STATE HIGHWAY 603 AND 43.  CONTINUE
BH0984'WEST ON U.S. HIGHWAY 90 FOR 4.8 MILES TO A CROSSROAD.  CONTINUE
BH0984'WEST ON U.S. HIGHWAY 90 FOR 2.4 MILES TO THE STATION ON THE
BH0984'RIGHT.
BH0984'
BH0984'AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN
BH0984'7.8 MILES NORTHEAST OF PEARLINGTON.
BH0984
BH0984                          STATION RECOVERY (1972)
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 BH0984
 BH0984'RECOVERY NOTE BY MISSISSIPPI STATE HIGHWAY DEPARTMENT 1972
 BH0984'7.8 MI NE FROM PEARLINGTON.
 BH0984'THE MARK IS LOCATED 7.8 MILES NORTHEAST OF PEARLINGTON ON THE NORTH
 BH0984'ROW OF U.S. HIGHWAY 90, 9.6 MILES WEST OF BAY ST. LOUIS, 0.4 MILES
 BH0984'EAST OF THE JUNCTION OF U.S. HIGHWAY 90 AND STATE HIGHWAY 607 IN THE
 BH0984'SOUTHEAST 1/4 OF SECTION 33, T 8S, R 15W.  IT IS 75.5 FEET NORTH OF
 BH0984'THE CENTER OF THE NORTH LANE OF U.S. HIGHWAY 90, 108 FEET WEST OF THE
 BH0984'SOUTH POST OF A LARGE SIGN, 105 FEET EAST OF A POWER POLE WITH A GUY
 BH0984'WIRE WHERE THE LINE ENDS, 49.5 FEET NORTHWEST OF THE NORTH POST OF THE
 BH0984'PEARLINGTON NEXT LEFT SIGN, 1.5 FEET NORTHWEST OF A METAL WITNESS POST
 BH0984'SET IN THE TOP OF A 12 INCH ROUND CONCRETE POST ABOUT 1 FOOT BELOW THE
 BH0984'LEVEL OF THE HIGHWAY AND PROJECTS 4 INCHES.  TO REACH FROM THE WEST
 BH0984'END OF THE BRIDGE OVER ST. LOUIS BAY AT BAY ST. LOUIS GO WEST ON U.S.
 BH0984'HIGHWAY 90 FOR 3.5 MILES TO THE JUNCTION OF STATE HIGHWAY 603 AND 43.
 BH0984'CONTINUE WEST ON U.S. HIGHWAY 90 FOR 4.8 MILES TO A CROSSROAD.
 BH0984'CONTINUE WEST ON U.S. HIGHWAY 90 FOR 2.4 MILES TO THE MARK ON THE
 BH0984'RIGHT.
 BH0984
 BH0984                          STATION RECOVERY (1974)
 BH0984
 BH0984'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1974 (CDS)
 BH0984'STATION AND REFERENCE MARKS ARE IN GOOD CONDITION WITNESS POST
 BH0984'2 FEET SW OF STATION MARK.
 BH0984
 BH0984                          STATION RECOVERY (1976)
 BH0984
 BH0984'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1976
 BH0984'RECOVERED IN GOOD CONDITION.
 BH0984
 BH0984                          STATION RECOVERY (1993)
 BH0984
 BH0984'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1993
 BH0984'11.5 KM (7.15 MI) WESTERLY ALONG U.S. HIGHWAY 90 FROM THE JUNCTION
 BH0984'OF STATE HIGHWAY 43 IN WAVELAND, 150.0 M (492.1 FT) WEST OF THE
 BH0984'EXTENDED CENTER OF A DIRT ROAD LEADING SOUTH, 25.9 M (85.0 FT) EAST
 BH0984'OF REFERENCE MARK 5, 23.1 M (75.8 FT) NORTH OF THE CENTERLINE OF THE
 BH0984'WESTBOUND LANES OF THE HIGHWAY, 12.3 M (40.4 FT) WEST OF REFERENCE
 BH0984'MARK 4, 0.5 M (1.6 FT) NORTHEAST OF A WITNESS POST, AND THE MONUMENT
 BH0984'PROJECTS 0.05 M (0.16 FT) ABOVE THE GROUND SURFACE.
 BH0984
 BH0984                          STATION RECOVERY (2006)
 BH0984
 BH0984'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 BH0984'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH1119 ***********************************************************************
 BH1119  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH1119  DESIGNATION -  C 189
 BH1119  PID         -  BH1119
 BH1119  STATE/COUNTY-  LA/ORLEANS
 BH1119  USGS QUAD   -  CHEF MENTEUR (1994)
 BH1119
 BH1119                         *CURRENT SURVEY CONTROL
 BH1119  ___________________________________________________________________
 BH1119* NAD 83(1992)-  30 04 24.49899(N)    089 50 25.90012(W)     ADJUSTED
 BH1119* NAVD 88     -         0.63 **(meters)       2.1  **(feet)  LEVELING(2004.65)
 BH1119  **This station is located in a subsidence area (see below).
 BH1119  **This station is included in the VTDP model (see below).
 BH1119  ___________________________________________________________________
 BH1119  EPOCH DATE  -       2004.65
 BH1119  X           -      15,375.449 (meters)                     COMP
 BH1119  Y           -  -5,524,136.168 (meters)                     COMP
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BH1119  Z           -   3,177,411.655 (meters)                    COMP
BH1119  LAPLACE CORR-          -0.12  (seconds)                   DEFLEC99
BH1119  ELLIP HEIGHT-         -25.72  (meters)          (06/22/05) GPS OBS
BH1119  GEOID HEIGHT-         -26.34  (meters)                    GEOID03
BH1119  DYNAMIC HT  -           0.63  (meters)       2.1   (feet)  COMP
BH1119  MODELED GRAV-     979,321.3   (mgal)                      NAVD 88
BH1119
BH1119  HORZ ORDER  -  B
BH1119  VERT ORDER  -  THIRD
BH1119  ELLP ORDER  -  FOURTH    CLASS I
BH1119
BH1119.The horizontal coordinates were established by GPS observations
BH1119.and adjusted by the National Geodetic Survey in June 2005..
BH1119.The horizontal coordinates are valid at the epoch date displayed above.

BH1119.The epoch date for horizontal control is a decimal equivalence
BH1119.of Year/Month/Day.
BH1119
BH1119 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH1119 ** and geoid heights are valid at the date of observation. These heights
BH1119 ** must always be validated when used as control.
BH1119 ** The orthometric height was determined with a Vertical Time-dependent
BH1119 ** Positioning (VTDP) model and has been validated through GPS observations
BH1119 ** for the epoch indicated (see www.ngs.noaa.gov/heightmod/VTDP).
BH1119 ** The geoid height was determined by a new realization of GEOID03 for the
BH1119 ** epoch indicated which incorporates improved geoid heights for the
BH1119 ** Southern Louisiana Subsidence area
BH1119 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH1119.The orthometric height was determined by differential leveling.
BH1119.The vertical network tie was performed by a horz. field party for horz.
BH1119.obs reductions. Reset procedures were used to establish the elevation.
BH1119
BH1119.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH1119
BH1119.The Laplace correction was computed from DEFLEC99 derived deflections.
BH1119
BH1119.The ellipsoidal height was determined by GPS observations
BH1119.and is referenced to NAD 83.
BH1119
BH1119.The geoid height was determined by GEOID03.
BH1119
BH1119.The dynamic height is computed by dividing the NAVD 88
BH1119.geopotential number by the normal gravity value computed on the
BH1119.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH1119.degrees latitude (g = 980.6199 gals.).
BH1119
BH1119.The modeled gravity was interpolated from observed gravity values.
BH1119
BH1119;                    North         East     Units Scale Factor Converg.
BH1119;SPC LA S     -   175,347.837 1,143,914.390   MT  0.99992654   +0 44 47.1
BH1119;SPC LA S     -   575,287.03  3,752,992.46   sFT  0.99992654   +0 44 47.1
BH1119;UTM  16      - 3,330,329.700   226,183.461   MT  1.00052512   -1 25 27.5
BH1119
BH1119!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH1119!SPC LA S     -   1.00000404  x   0.99992654  =   0.99993058
BH1119!UTM  16      -   1.00000404  x   1.00052512  =   1.00052916
BH1119
BH1119                          SUPERSEDED SURVEY CONTROL
BH1119
BH1119  ELLIP H (01/21/03)  -25.68   (m)                      GP(        ) 4 2
BH1119  NAD 83(1992)-  30 04 24.49852(N)    089 50 25.89947(W) AD(        ) 1
BH1119  NAD 83(1992)-  30 04 24.49854(N)    089 50 25.89947(W) AD(        ) 1
BH1119  ELLIP H (01/21/93)  -25.66   (m)                      GP(        ) 4 2
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BH1119  NAD 83(1986)-  30 04 24.51432(N)    089 50 25.89678(W) AD(       ) 1
BH1119  NAVD 88 (12/05/96)    0.794  (m)            2.60   (f) ADJUSTED    1 1
BH1119  NAVD 88 (02/14/94)    0.789  (m)            2.59   (f) UNKNOWN     1 1
BH1119  NAVD 88 (06/15/91)    0.810  (m)            2.66   (f) UNKNOWN     1 1
BH1119  NGVD 29 (05/21/91)    0.851  (m)            2.79   (f) ADJUSTED    1 1
BH1119
BH1119.Superseded values are not recommended for survey control.
BH1119.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH1119.See file dsdata.txt to determine how the superseded data were derived.
BH1119
BH1119_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU2618330330(NAD 83)
BH1119_MARKER: DB = BENCH MARK DISK
BH1119_SETTING: 46 = COPPER-CLAD STEEL ROD W/O SLEEVE (10 FT.+)
BH1119_SP_SET: COPPER-CLAD STEEL ROD
BH1119_STAMPING: C 189 1963
BH1119_MARK LOGO: CGS
BH1119_PROJECTION: FLUSH
BH1119_MAGNETIC: N = NO MAGNETIC MATERIAL
BH1119_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
BH1119_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH1119+SATELLITE: SATELLITE OBSERVATIONS - January 08, 2006
BH1119_ROD/PIPE-DEPTH: 20.7 meters
BH1119_SLEEVE-DEPTH  : 1.00 meters
BH1119
BH1119  HISTORY     - Date     Condition        Report By
BH1119  HISTORY     - 1963     MONUMENTED       CGS
BH1119  HISTORY     - 1969     GOOD             CGS
BH1119  HISTORY     - 1970     GOOD             NGS
BH1119  HISTORY     - 1977     GOOD             NGS
BH1119  HISTORY     - 1978     GOOD             USE
BH1119  HISTORY     - 1985     GOOD             NGS
BH1119  HISTORY     - 1986     GOOD             NGS
BH1119  HISTORY     - 19880920 GOOD             LADTD
BH1119  HISTORY     - 19890123 GOOD
BH1119  HISTORY     - 19901101 GOOD             NGS
BH1119  HISTORY     - 19941024 GOOD             NGS
BH1119  HISTORY     - 20020703 GOOD             USACE
BH1119  HISTORY     - 20040413 GOOD             NGS
BH1119  HISTORY     - 20060108 GOOD             3001
BH1119
BH1119                          STATION DESCRIPTION
BH1119
BH1119'DESCRIBED BY COAST AND GEODETIC SURVEY 1969
BH1119'12.0 MI E FROM NEW ORLEANS.
BH1119'ABOUT 12.0 MILES EAST ALONG U. S. HIGHWAY 90 FROM THE I 10 OVERPASS
BH1119'OVER U. S. HIGHWAY 90 AT NEW ORLEANS, ABOUT 0.1 MILE NORTHWEST OF A
BH1119'LARGE METAL BUILDING FOR THE MARINE CENTER EAST, 58.7 FEET NORTHWEST
BH1119'OF THE SOUTH CORNER OF THE CHAIN LINK FENCE AROUND THE STORAGE YARD OF
BH1119'THE P. HUTCHISON DRAGLINE WORKS, 44 FEET NORTHEAST OF THE CENTER LINE
BH1119'OF THE WESTBOUND LANE OF THE HIGHWAY, 6 FEET EAST OF A 12-INCH OAK
BH1119'TREE, 0.9 FOOT SOUTHWEST OF FENCE LINE, 1.5 FEET NORTHWEST OF A METAL
BH1119'WITNESS POST, ABOUT LEVEL WITH THE HIGHWAY AND IS A DISK ON THE TOP OF
BH1119'A COPPER COATED STEEL ROD FLUSH WITH THE GROUND AND PROTECTED BY A 6
BH1119'INCH TILE WHICH IS FLUSH WITH THE GROUND.  THE ROD WAS DRIVEN TO A
BH1119'DEPTH OF 88 FEET.
BH1119
BH1119                          STATION RECOVERY (1970)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1970
BH1119'RECOVERED IN GOOD CONDITION.
BH1119
BH1119                          STATION RECOVERY (1977)
BH1119
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BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1977
BH1119'12.0 MILES EAST ALONG U.S. HIGHWAY 90 FROM THE INTERSTATE HIGHWAY
BH1119'10 OVERPASS, 0.1 MILE NORTHWEST OF A LARGE METAL BUILDING FOR
BH1119'HALTER MARINE SERVICES INCORPORATED, 44 FT. NORTHEAST OF THE CENTER
BH1119'LINE OF THE WEST BOUND LANES OF THE HIGHWAY, 59 FT. NORTHWEST
BH1119'OF THE SOUTH CORNER OF A STEEL MESH FENCE, 58.5 FT. SOUTHEAST OF
BH1119'THE APPROXIMATE CENTER LINE OF A SHELL DRIVEWAY LEADING NORTHEAST,
BH1119'6 FT. EAST OF A 12-INCH OAK TREE, 0.9 FT. SOUTHWEST OF A
BH1119'NORTHWEST-SOUTHEAST FENCE LINE, THE DISK IS PROTECTED BY A
BH1119'6-INCH SQUARE TILE.
BH1119
BH1119                          STATION RECOVERY (1978)
BH1119
BH1119'RECOVERY NOTE BY US ENGINEERS 1978
BH1119'RECOVERED IN GOOD CONDITION.
BH1119
BH1119                          STATION RECOVERY (1985)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1985
BH1119'RECOVERED IN GOOD CONDITION.
BH1119
BH1119                          STATION RECOVERY (1986)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986
BH1119'RECOVERED IN GOOD CONDITION.
BH1119
BH1119                          STATION RECOVERY (1988)
BH1119
BH1119'RECOVERY NOTE BY LA TRANSP AND DEV 1988
BH1119'ABOUT 19.3 KM (12.00 MI) EAST ALONG U.S. HIGHWAY 90 FROM THE
BH1119'INTERSTATE HIGHWAY 10 OVERPASS OVER U.S. HIGHWAY 90 AT NEW ORLEANS,
BH1119'ABOUT 0.2 KM (0.10 MI) NORTHWEST OF A LARGE METAL BUILDING FOR THE
BH1119'MARINE CENTER EAST, 17.9 M (58.7 FT) NORTHWEST OF THE SOUTH CORNER OF
BH1119'THE CHAIN LINK FENCE AROUND THE STORAGE YARD OF THE P. HUTCHINSON
BH1119'DRAGLINE WORKS, 13.4 M (44.0 FT) NORTHEAST OF THE CENTER LINE OF THE
BH1119'WESTBOUND LANE OF THE HIGHWAY, 6.7 M (22.0 FT) SOUTHEAST FROM THE
BH1119'CENTER OF A CHAIN LINK GATE, 0.3 M (1.0 FT) SOUTHWEST OF THE FENCE AND
BH1119'0.5 M (1.6 FT) NORTHWEST OF A METAL WITNESS POST.  THE MARK IS ABOUT
BH1119'LEVEL WITH THE HIGHWAY AND PROTECTED BY A 6-INCH TILE WHICH IS FLUSH
BH1119'WITH THE GROUND.
BH1119
BH1119                          STATION RECOVERY (1989)
BH1119
BH1119'RECOVERED 1989
BH1119'RECOVERED IN GOOD CONDITION.
BH1119
BH1119                          STATION RECOVERY (1990)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
BH1119'19.3 KM (12.0 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1119'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS,
BH1119'0.2 KM (0.1 MI) NORTHWEST OF A LARGE METAL BUILDING (VACANT 1990),
BH1119'18.0 M (59.1 FT) NORTHWEST OF THE SOUTH CORNER OF STEEL MESH FENCE,
BH1119'17.8 M (58.4 FT) SOUTHEAST OF THE CENTER OF A SHELLED DRIVEWAY, 13.4
BH1119'M (44.0 FT) NORTHEAST OF THE CENTERLINE OF THE WESTBOUND LANES OF THE
BH1119'HIGHWAY, 0.4 M (1.3 FT) NORTHWEST OF A WITNESS POST, AND 0.3 M (1.0
BH1119'FT) SOUTHWEST OF A FENCE.  NOTE--THE DISK IS ENCASED IN A 6-INCH
BH1119'SQUARE PIPE THAT IS FLUSH WITH THE GROUND SURFACE.
BH1119
BH1119                          STATION RECOVERY (1994)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
BH1119'19.1 KM (11.85 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
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BH1119'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS,
BH1119'18.0 M (59.1 FT) NORTHWEST OF THE SOUTH CORNER OF A CHAIN-LINK FENCE,
BH1119'17.8 M (58.4 FT) SOUTHEAST OF THE CENTER OF A SHELLED DRIVEWAY, 13.4 M
BH1119'(44.0 FT) NORTHEAST OF AND LEVEL WITH THE CENTERLINE OF THE WESTBOUND
BH1119'LANES OF THE HIGHWAY, 1.5 M (4.9 FT) NORTHEAST OF THE CENTER OF A
BH1119'WATER METER COVER, 0.4 M (1.3 FT) NORTHWEST OF A WITNESS POST, AND 0.3
BH1119'M (1.0 FT) SOUTHWEST OF A FENCE.  NOTE--THE DISK IS ENCASED IN A
BH1119'6-INCH METAL PIPE AND IS RECESSED 0.1 M (0.3 FT) BELOW THE GROUND
BH1119'SURFACE.
BH1119
BH1119                          STATION RECOVERY (2002)
BH1119
BH1119'RECOVERY NOTE BY US ARMY CORPS OF ENGINEERS 2002 (MWH)
BH1119'SOME OBSTRUCTIONS BUT IS MARGINALLY SUITABLE FOR GPS OBSERVATIONS.
BH1119
BH1119                          STATION RECOVERY (2004)
BH1119
BH1119'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
BH1119'THE STATION IS LOCATED EAST OF NEW ORLEANS ALONG US HIGHWAY 90 ABOUT 7
BH1119'MILES EAST OF MICHOUD.
BH1119'
BH1119'TO REACH THE STATION FROM EXIT 246, INTERSTATE HIGHWAY 10 AND
BH1119'INTERSTATE HIGHWAY  510  NORTHEAST OF NEW ORLEANS, GO SOUTH FOR 2.0 MI
BH1119'ON  INTERSTATE HIGHWAYT 510  THE US HIGHWAY 90  EXIT (EXIT 2C), TAKE
BH1119'THE EXIT TO A TRAFFIC LIGHT.  TURN LEFT, AND GO EASTERLY ON US 90,
BH1119'CHEF MENTEUR  HWY, FOR 6.25 MI TO THEJUNCTION WITH US 11, CONTINUE
BH1119'EASTERLY ON US HIGHWAY 90 FOR 1.45  MI. TO THE  MARK ON THE LEFT ALONG
BH1119'A FENCELINE.
BH1119'
BH1119'THE MARK IS LOCATED 1FT ENE OF THE WITNESS POST,0.9 FT NE OF A 5 FOOT
BH1119'FENCE, 5.3 FT NNE OF A 12 INCH  DIAMETER WATER METER COVER, 11 S OF AN
BH1119'ELECTRIC SERVICE POLE, 55 FT NE OF THE CENTERLINE OF US 90,  AND 115
BH1119'ESE OF MILE MARKER 287.  NOTE--THE MARK IS ENCASED IN A 6 INCH PIPE
BH1119'RECESSED 0.3 FEET BELOW  THE LEVEL OF THE GROUND IN AN AREA INUNDATED
BH1119'WITH WATER AFTER HEAVEY RAINS.
BH1119
BH1119                          STATION RECOVERY (2006)
BH1119
BH1119'RECOVERY NOTE BY 3001, INC 2006 (JCP)
BH1119'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
DG6568 ***********************************************************************
DG6568  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
DG6568  CORS         -  This is a GPS Continuously Operating Reference Station.
DG6568  DESIGNATION -  COVINGTON CORS ARP
DG6568  CORS_ID      -  COVG
DG6568  PID          -  DG6568
DG6568  STATE/COUNTY-  LA/ST TAMMANY
DG6568  USGS QUAD    -  COVINGTON (1994)
DG6568
DG6568                         *CURRENT SURVEY CONTROL
DG6568  ___________________________________________________________________
DG6568* NAD 83(CORS)-  30 28 33.26965(N)    090 05 43.92326(W)     ADJUSTED
DG6568* NAVD 88      -        22.39 **(meters)      73.5  **(feet)  GPS OBS(2004.65)
DG6568  **This station is located in a subsidence area (see below).
DG6568  ___________________________________________________________________
DG6568  EPOCH DATE  -        2002.00
DG6568  X           -      -9,173.433 (meters)                      COMP
DG6568  Y           -  -5,501,676.859 (meters)                      COMP
DG6568  Z           -   3,215,950.683 (meters)                      COMP
DG6568  ELLIP HEIGHT-          -4.56  (meters)          (08/??/04) GPS OBS
DG6568  GEOID HEIGHT-         -26.98  (meters)                      GEOID03
DG6568
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 DG6568  HORZ ORDER  -  SPECIAL (CORS)
 DG6568  ELLP ORDER  -  SPECIAL (CORS)
 DG6568
 DG6568.ITRF positions are available for this station.
 DG6568.The coordinates were established by GPS observations
 DG6568.and adjusted by the National Geodetic Survey in August 2004..
 DG6568.The coordinates are valid at the epoch date displayed above.
 DG6568.The epoch date for horizontal control is a decimal equivalence
 DG6568.of Year/Month/Day.
 DG6568
 DG6568 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 DG6568 ** and geoid heights are valid at the date of observation. These heights
 DG6568 ** must always be validated when used as control.
 DG6568 ** The orthometric height was determined by GPS observations using
 DG6568 ** precise GPS observation and processing techniques and a new
 DG6568 ** realization of GEOID03. It supersedes the leveled height previously
 DG6568 ** determined for this station.
 DG6568 ** The geoid height was determined by a new realization of GEOID03 for the
 DG6568 ** epoch indicated which incorporates improved geoid heights for the
 DG6568 ** Southern Louisiana Subsidence area.
 DG6568 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 DG6568.The orthometric height was determined by GPS observations and a
 DG6568.high-resolution geoid model using precise GPS observation and
 DG6568.processing techniques.
 DG6568
 DG6568.The PID for the CORS L1 Phase Center is DG6569.
 DG6568
 DG6568.The XYZ, and position/ellipsoidal ht. are equivalent.
 DG6568
 DG6568.The ellipsoidal height was determined by GPS observations
 DG6568.and is referenced to NAD 83.
 DG6568
 DG6568.The geoid height was determined by GEOID03.
 DG6568
 DG6568;                    North         East     Units Scale Factor Converg.
 DG6568;SPC LA S     -   219,662.521 1,118,849.594   MT  0.99996000   +0 37 08.1
 DG6568;SPC LA S     -   720,676.12  3,670,759.04   sFT  0.99996000   +0 37 08.1
 DG6568
 DG6568!             -  Elev Factor  x  Scale Factor =   Combined Factor
 DG6568!SPC LA S     -   1.00000072  x   0.99996000  =   0.99996072
 DG6568
 DG6568                         SUPERSEDED SURVEY CONTROL
 DG6568
 DG6568.No superseded survey control is available for this station.
 DG6568
 DG6568_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYP7884175108(NAD 83)
 DG6568_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 DG6568
 DG6568                         STATION DESCRIPTION
 DG6568
 DG6568'DESCRIBED BY NATIONAL GEODETIC SURVEY 2004
 DG6568'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
 DG6568'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
 DG6568'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
 DG6568'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
 DG6568'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AU2196 ***********************************************************************
 AU2196  HT_MOD      -  This is a Louisiana Height Modernization Survey Station.
 AU2196  DESIGNATION -  DISTRICT 1 A
 AU2196  PID         -  AU2196
 AU2196  STATE/COUNTY-  LA/ORLEANS
 AU2196  USGS QUAD   -  NEW ORLEANS WEST (1992)
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AU2196
AU2196                         *CURRENT SURVEY CONTROL
AU2196  ___________________________________________________________________
AU2196* NAD 83(1992)-  29 55 53.38291(N)    090 08 02.35063(W)     ADJUSTED
AU2196* NAVD 88     -         3.30 **(meters)      10.8  **(feet)  GPS OBS(2004.65)
AU2196  **This station is located in a subsidence area (see below).
AU2196  ___________________________________________________________________
AU2196  X           -     -12,936.651 (meters)                     COMP
AU2196  Y           -  -5,532,014.848 (meters)                     COMP
AU2196  Z           -   3,163,783.648 (meters)                     COMP
AU2196  LAPLACE CORR-           0.03  (seconds)                    DEFLEC99
AU2196  ELLIP HEIGHT-         -22.70  (meters)          (12/29/04) GPS OBS
AU2196  GEOID HEIGHT-         -26.01  (meters)                     GEOID03
AU2196  DYNAMIC HT  -           3.29  (meters)      10.8   (feet)  COMP
AU2196  MODELED GRAV-     979,312.2   (mgal)                       NAVD 88
AU2196
AU2196  HORZ ORDER  -  B
AU2196  VERT ORDER  -  FIRST     CLASS II (See Below)
AU2196  ELLP ORDER  -  FOURTH    CLASS I
AU2196
AU2196.The horizontal coordinates were established by GPS observations
AU2196.and adjusted by the National Geodetic Survey in December 2004..
AU2196
AU2196 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AU2196 ** and geoid heights are valid at the date of observation. These heights
AU2196 ** must always be validated when used as control.
AU2196 ** The orthometric height was determined by GPS observations using
AU2196 ** precise GPS observation and processing techniques and a new
AU2196 ** realization of GEOID03. It supersedes the leveled height previously
AU2196 ** determined for this station.
AU2196 ** The geoid height was determined by a new realization of GEOID03 for the
AU2196 ** epoch indicated which incorporates improved geoid heights for the
AU2196 ** Southern Louisiana Subsidence area.
AU2196 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AU2196.The orthometric height was determined by GPS observations and a
AU2196.high-resolution geoid model using precise GPS observation and
AU2196.processing techniques. It supersedes the leveled height previously
AU2196.determined for this station.
AU2196.WARNING-GPS observations at this control monument resulted in a GPS
AU2196.derived orthometric height which differed from the leveled height by
AU2196.more than one decimeter (0.1 meter).
AU2196.The vertical order pertains to the first NAVD 88 superseded value.
AU2196
AU2196.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AU2196
AU2196.The Laplace correction was computed from DEFLEC99 derived deflections.
AU2196
AU2196.The ellipsoidal height was determined by GPS observations
AU2196.and is referenced to NAD 83.
AU2196
AU2196.The geoid height was determined by GEOID03.
AU2196
AU2196.The dynamic height is computed by dividing the NAVD 88
AU2196.geopotential number by the normal gravity value computed on the
AU2196.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AU2196.degrees latitude (g = 980.6199 gals.).
AU2196
AU2196.The modeled gravity was interpolated from observed gravity values.
AU2196
AU2196;                    North         East     Units Scale Factor Converg.
AU2196;SPC LA S     -   159,279.058 1,115,789.304   MT  0.99992647   +0 35 58.9
AU2196;SPC LA S     -   522,568.04  3,660,718.74   sFT  0.99992647   +0 35 58.9
AU2196;UTM  15      - 3,314,648.999   776,668.392   MT  1.00054452   +1 25 51.4
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AU2196
AU2196!              -  Elev Factor  x  Scale Factor =   Combined Factor
AU2196!SPC LA S      -   1.00000357  x   0.99992647  =   0.99993003
AU2196!UTM  15       -   1.00000357  x   1.00054452  =   1.00054809
AU2196
AU2196                          SUPERSEDED SURVEY CONTROL
AU2196
AU2196  NAVD 88 (12/05/96)    3.450  (m)           11.32   (f) ADJUSTED    1 2
AU2196  NAVD 88 (02/14/94)    3.435  (m)           11.27   (f) UNKNOWN     1 2
AU2196  NGVD 29 (05/21/91)    3.495  (m)           11.47   (f) ADJUSTED    1 2
AU2196
AU2196.Superseded values are not recommended for survey control.
AU2196.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AU2196.See file dsdata.txt to determine how the superseded data were derived.
AU2196
AU2196_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYP7666814649(NAD 83)
AU2196_MARKER: I = METAL ROD
AU2196_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AU2196_SP_SET: STAINLESS STEEL ROD
AU2196_STAMPING: DISTRICT 1 A
AU2196_MARK LOGO: USE
AU2196_PROJECTION: RECESSED 10 CENTIMETERS
AU2196_MAGNETIC: I = MARKER IS A STEEL ROD
AU2196_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AU2196_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AU2196+SATELLITE: SATELLITE OBSERVATIONS - January 08, 2006
AU2196_ROD/PIPE-DEPTH: 18.2 meters
AU2196
AU2196  HISTORY     - Date     Condition        Report By
AU2196  HISTORY     - 1985     MONUMENTED       USE
AU2196  HISTORY     - 1985     GOOD             NGS
AU2196  HISTORY     - 19901110 GOOD             NGS
AU2196  HISTORY     - 19941108 GOOD             NGS
AU2196  HISTORY     - 20011119 GOOD             3001
AU2196  HISTORY     - 20060108 GOOD             3001
AU2196
AU2196                          STATION DESCRIPTION
AU2196
AU2196'DESCRIBED BY NATIONAL GEODETIC SURVEY 1985
AU2196'IN NEW ORLEANS.
AU2196'THE MARK IS 0.91 M ABOVE TRACKS.
AU2196'IN NEW ORLEANS, 1.2 KM (0.75 MI) SOUTH ALONG RIVER ROAD FROM THE
AU2196'JUNCTION OF CARROLLTON AVENUE TO THE MARK ON THE RIGHT, AT THE SOUTH
AU2196'END OF THE U.S. ENGINEERS PROPERTY, AT THE TOE OF THE LEVEE,
AU2196'SURROUNDED BY 3 METAL POSTS PAINTED YELLOW, 16.33 METERS (53.6 FT)
AU2196'WEST OF THE WEST RAIL OF THE NEW ORLEANS PUBLIC BELT RAILROAD,
AU2196'12.10 METERS (39.7 FT) SOUTHWEST OF THE SOUTHEAST CORNER POST OF A
AU2196'CHAIN LINK FENCE, 18.59 METERS (61.0 FT) NORTH OF THE NORTH EDGE OF A
AU2196'WALKWAY CROSSING THE LEVEE, 2.22 METERS (7.3 FT) SOUTH OF A CHAIN LINK
AU2196'FENCE.
AU2196
AU2196                          STATION RECOVERY (1990)
AU2196
AU2196'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
AU2196'0.4 KM (0.2 MI) NORTHERLY ALONG LAKE AVENUE FROM THE INTERSECTION OF
AU2196'MAGAZINE STREET IN NEW ORLEANS, AT THE SOUTH END OF THE U.S. CORP OF
AU2196'ENGINEERS PROPERTY, 43.4 M (142.4 FT) NORTH OF A HIGH LINE TOWER,
AU2196'31.3 M (102.7 FT) WEST OF THE WEST CURB OF THE AVENUE, 16.3 M (53.5
AU2196'FT) WEST OF THE NEAR RAIL OF THE NEW ORLEANS PUBLIC BELT RAILROAD,
AU2196'12.0 M (39.4 FT) WEST-SOUTHWEST OF A CHAIN-LINK FENCE CORNER, 2.0 M
AU2196'(6.6 FT) SOUTHEAST OF THE FENCE, 1.0 M (3.3 FT) ABOVE THE LEVEL OF
AU2196'THE AVENUE, AND NEAR THE CENTER OF 3 METAL POSTS PAINTED YELLOW.
AU2196'NOTE--ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH LOGO CAP.
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 AU2196
 AU2196                          STATION RECOVERY (1994)
 AU2196
 AU2196'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
 AU2196'IN NEW ORLEANS, AT 7400 LEAKE AVENUE, 20.8 M (68.2 FT) SOUTHEAST OF
 AU2196'THE SOUTHEAST CORNER OF THE U.S. CORPS OF ENGINEERS DISTRICT WAREHOUSE
 AU2196'816 AT 7400 LEAKE AVENUE, 18.5 M (60.7 FT) NORTH OF THE NORTH EDGE OF
 AU2196'A SIDEWALK LEADING TO THE TOP OF A LEVEE, 11.8 M (38.7 FT) SOUTHWEST
 AU2196'OF THE SOUTHWEST CORNER OF A CHAIN-LINK FENCE ENCLOSING THE DISTRICT
 AU2196'HEADQUARTERS, 2.1 M (6.9 FT) SOUTH OF A FENCE, 0.15 M (0.49 FT) BELOW
 AU2196'THE GROUND SURFACE, AND THE MARK IS NEAR THE CENTER OF 3 CONCRETE
 AU2196'FILLED PIPES PROJECTING 3-FEET ABOVE THE GROUND SURFACE.  NOTE--ACCESS
 AU2196'TO THE DATUM POINT IS THROUGH A 5-INCH LOGO CAP.
 AU2196
 AU2196                          STATION RECOVERY (2001)
 AU2196
 AU2196'RECOVERY NOTE BY 3001, INC 2001 (KC)
 AU2196'THE STATION IS LOCATED IN NEW ORLEANS, 2.4 MILES SOUTHEAST OF THE HUEY
 AU2196'P. LONG BRIDGE ,  2.85 MILES SOUTH OF HWY 61, 4.4 MILES WEST OF THE
 AU2196'GREATER NEW ORLEANS BRIDGE.
 AU2196'
 AU2196'OWNERSHIP- COE
 AU2196'
 AU2196'TO REACH THE STATION FROM THE INTERSECTION OF CARROLLTON AVE. AND
 AU2196'RIVER ROAD GO SOUTH  FOR .75 MILES TO A MARK ON THE RIGHT, WEST AND
 AU2196'ACROSS CHAIN LINK FENCE. ALSO STATION IS  ACCESSABLE FROM THE SOUTHERN
 AU2196'MOST GUARD GATE AT COE ENTRANCE THEN SOUTH ON A SMALL  ASPHALT ROAD
 AU2196'JUST WEST OF THE RAILROAD TRACKS TO A CHAIN LINK FENCE CORNER ON RIGHT
 AU2196'AND THREE YELLOW PIPES SURROUNDING MARK.
 AU2196'
 AU2196'THE STATION IS 68.2' SOUTHEAST OF THE SOUTHEAST CORNER OF US CORPS
 AU2196'DISTRICT WAREHOUSE  BUILDING, 60' NORTH OF THE NORTH EDGE OF A
 AU2196'SIDEWALK LEADING OVER LEVEE, 38.7' SOUTHWEST  OF THE SOUTHWEST CORNER
 AU2196'OF A CHAIN LINK FENCE ENCLOSING THE DISTRICT HEADQUATERS, 69'  SOUTH
 AU2196'OF THE FENCE, .5' BELOW THE SURFACE AND SURROUNDED BY THREE CONCRETE
 AU2196'FILLED  STEEL PIPES. STATION IS A ROD DRIVEN 18.2 METERS AND STAMPED
 AU2196'DISTRICT 1A.
 AU2196
 AU2196                          STATION RECOVERY (2006)
 AU2196
 AU2196'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AU2196'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH1133 ***********************************************************************
 BH1133  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH1133  TIDAL BM     -  This is a Tidal Bench Mark.
 BH1133  DESIGNATION -  E 3145
 BH1133  PID          -  BH1133
 BH1133  STATE/COUNTY-  LA/ORLEANS
 BH1133  USGS QUAD    -  CHEF MENTEUR (1994)
 BH1133
 BH1133                         *CURRENT SURVEY CONTROL
 BH1133  ___________________________________________________________________
 BH1133* NAD 83(1992)-  30 04 06.73061(N)    089 48 13.12979(W)     ADJUSTED
 BH1133* NAVD 88      -         4.82 **(meters)      15.8  **(feet)  GPS OBS(2004.65)
 BH1133  **This station is located in a subsidence area (see below).
 BH1133  ___________________________________________________________________
 BH1133  EPOCH DATE  -        2004.65
 BH1133  X            -      18,932.222 (meters)                    COMP
 BH1133  Y            -  -5,524,402.922 (meters)                    COMP
 BH1133  Z            -   3,176,940.272 (meters)                    COMP
 BH1133  LAPLACE CORR-           -0.16  (seconds)                   DEFLEC99
 BH1133  ELLIP HEIGHT-          -21.51  (meters)          (04/11/06) GPS OBS
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BH1133  GEOID HEIGHT-         -26.33  (meters)                     GEOID03
BH1133  DYNAMIC HT  -           4.81  (meters)      15.8   (feet)  COMP
BH1133  MODELED GRAV-     979,321.3   (mgal)                       NAVD 88
BH1133
BH1133  HORZ ORDER  -  B
BH1133  VERT ORDER  -  FIRST     CLASS I (See Below)
BH1133  ELLP ORDER  -  FOURTH    CLASS II
BH1133
BH1133.The horizontal coordinates were established by GPS observations
BH1133.and adjusted by the National Geodetic Survey in April 2006..
BH1133.The horizontal coordinates are valid at the epoch date displayed above.
BH1133.The epoch date for horizontal control is a decimal equivalence
BH1133.of Year/Month/Day.
BH1133
BH1133 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH1133 ** and geoid heights are valid at the date of observation. These heights
BH1133 ** must always be validated when used as control.
BH1133 ** The orthometric height was determined by GPS observations using
BH1133 ** precise GPS observation and processing techniques and a new
BH1133 ** realization of GEOID03. It supersedes the leveled height previously
BH1133 ** determined for this station.
BH1133 ** The geoid height was determined by a new realization of GEOID03 for the
BH1133 ** epoch indicated which incorporates improved geoid heights for the
BH1133 ** Southern Louisiana Subsidence area.
BH1133 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH1133.The orthometric height was determined by GPS observations and a
BH1133.high-resolution geoid model using precise GPS observation and
BH1133.processing techniques. It supersedes the leveled height previously
BH1133.determined for this station.
BH1133.WARNING-GPS observations at this control monument resulted in a GPS
BH1133.derived orthometric height which differed from the leveled height by
BH1133.more than one decimeter (0.1 meter).
BH1133.The vertical order pertains to the first NAVD 88 superseded value.
BH1133
BH1133.This Tidal Bench Mark is designated as VM 7175
BH1133.by the Center for Operational Oceanographic Products and Services.
BH1133
BH1133.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH1133
BH1133.The Laplace correction was computed from DEFLEC99 derived deflections.
BH1133
BH1133.The ellipsoidal height was determined by GPS observations
BH1133.and is referenced to NAD 83.
BH1133
BH1133.The geoid height was determined by GEOID03.
BH1133
BH1133.The dynamic height is computed by dividing the NAVD 88
BH1133.geopotential number by the normal gravity value computed on the
BH1133.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH1133.degrees latitude (g = 980.6199 gals.).
BH1133
BH1133.The modeled gravity was interpolated from observed gravity values.
BH1133
BH1133;                    North         East     Units Scale Factor Converg.
BH1133;SPC LA S     -   174,847.681 1,147,476.975   MT  0.99992644   +0 45 53.5
BH1133;SPC LA S     -   573,646.10  3,764,680.71   sFT  0.99992644   +0 45 53.5
BH1133;UTM  16      - 3,329,694.598   229,726.625   MT  1.00050133   -1 24 20.1
BH1133
BH1133!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH1133!SPC LA S     -   1.00000338  x   0.99992644  =   0.99992982
BH1133!UTM  16      -   1.00000338  x   1.00050133  =   1.00050471
BH1133
BH1133                          SUPERSEDED SURVEY CONTROL
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BH1133
BH1133  NAVD 88 (12/05/96)    4.987  (m)           16.36   (f) ADJUSTED    1 1
BH1133  NAVD 88 (02/14/94)    4.976  (m)           16.33   (f) UNKNOWN     1 1
BH1133  NAVD 88 (06/15/91)    4.996  (m)           16.39   (f) UNKNOWN     1 1
BH1133  NGVD 29 (05/21/91)    5.038  (m)           16.53   (f) ADJUSTED    1 1
BH1133
BH1133.Superseded values are not recommended for survey control.
BH1133.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH1133.See file dsdata.txt to determine how the superseded data were derived.
BH1133
BH1133_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU2972729695(NAD 83)
BH1133_MARKER: DD = SURVEY DISK
BH1133_SETTING: 35 = SET IN A MAT FOUNDATION OR CONCRETE SLAB OTHER THAN
BH1133+WITH SETTING: PAVEMENT
BH1133_SP_SET: DISK SET IN A CONCRETE BRIDGE DE
BH1133_STAMPING: E 3145
BH1133_MARK LOGO: LAGS
BH1133_MAGNETIC: N = NO MAGNETIC MATERIAL
BH1133_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
BH1133+STABILITY: SURFACE MOTION
BH1133_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH1133+SATELLITE: SATELLITE OBSERVATIONS - January 09, 2006
BH1133
BH1133  HISTORY     - Date     Condition        Report By
BH1133  HISTORY     - UNK      MONUMENTED       LAGS
BH1133  HISTORY     - 1969     GOOD             CGS
BH1133  HISTORY     - 1970     GOOD             NGS
BH1133  HISTORY     - 1977     GOOD             NGS
BH1133  HISTORY     - 1981     GOOD             USGS
BH1133  HISTORY     - 1985     GOOD             NGS
BH1133  HISTORY     - 1986     MARK NOT FOUND   NGS
BH1133  HISTORY     - 19901019 GOOD             NGS
BH1133  HISTORY     - 19941024 GOOD             NGS
BH1133  HISTORY     - 20060109 GOOD             LAGS
BH1133
BH1133                          STATION DESCRIPTION
BH1133
BH1133'DESCRIBED BY COAST AND GEODETIC SURVEY 1969
BH1133'14.65 MI E FROM NEW ORLEANS.
BH1133'ABOUT 14.65 MILES EAST ALONG U. S. HIGHWAY 90 FROM THE I 10 OVERPASS
BH1133'OVER U. S. HIGHWAY 90 AT NEW ORLEANS, AT THE NORTHEAST END OF THE
BH1133'HIGHWAY BRIDGE OVER CHEF MENTEUR PASS, SET IN THE CONCRETE BRIDGE
BH1133'FLOOR, 247 FEET SOUTHWEST OF THE NORTHEAST END OF THE BRIDGE, 2.5 FEET
BH1133'NORTHEAST OF THE NORTHEAST END OF THE STEEL SPAN OF THE BRIDGE, 9 FEET
BH1133'NORTHWEST OF THE CENTER LINE OF THE BRIDGE AND 0.5 FOOT SOUTHEAST OF
BH1133'THE SOUTHEAST FACE OF THE NORTHWEST GUARD RAIL BASE.
BH1133
BH1133                          STATION RECOVERY (1970)
BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1970
BH1133'RECOVERED IN GOOD CONDITION.
BH1133
BH1133                          STATION RECOVERY (1977)
BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1977
BH1133'RECOVERED IN GOOD CONDITION.
BH1133
BH1133                          STATION RECOVERY (1981)
BH1133
BH1133'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1981
BH1133'RECOVERED IN GOOD CONDITION.
BH1133
BH1133                          STATION RECOVERY (1985)
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BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1985
BH1133'RECOVERED IN GOOD CONDITION.
BH1133
BH1133                          STATION RECOVERY (1986)
BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986
BH1133'NOT RECOVERED, AFTER A THOROUGH SEARCH WAS MADE NO EVIDENCE OF THE
BH1133'MARK WAS FOUND.
BH1133
BH1133                          STATION RECOVERY (1990)
BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
BH1133'23.6 KM (14.7 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1133'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY IN NEW ORLEANS, IN
BH1133'THE CONCRETE BRIDGE DECK AT THE NORTHEAST END OF THE HIGHWAY BRIDGE
BH1133'SPANNING CHEF MENTEUR PASS, 75.3 M (247.0 FT) SOUTHWEST OF THE
BH1133'NORTHEAST END OF THE BRIDGE, 2.7 M (8.9 FT) NORTHWEST OF THE
BH1133'CENTERLINE OF THE HIGHWAY, 0.8 M (2.6 FT) NORTHEAST OF THE NORTHEAST
BH1133'END OF THE STEEL SPAN OF THE BRIDGE, AND 0.15 M (0.49 FT) SOUTHEAST
BH1133'OF THE SOUTHEAST FACE OF THE NORTHWEST BRIDGE RAIL.
BH1133
BH1133                          STATION RECOVERY (1994)
BH1133
BH1133'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
BH1133'23.0 KM (14.30 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1133'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS, IN
BH1133'THE CONCRETE DECK OF THE HIGHWAY BRIDGE SPANNING CHEF MENTEUR PASS,
BH1133'75.3 M (247.0 FT) SOUTHWEST OF THE NORTHEAST END OF THE BRIDGE, 2.7 M
BH1133'(8.9 FT) NORTHWEST OF AND LEVEL WITH THE HIGHWAY CENTERLINE, 0.8 M
BH1133'(2.6 FT) NORTHEAST OF THE NORTHEAST END OF THE STEEL SPAN OF THE
BH1133'BRIDGE, AND 0.1 M (0.3 FT) SOUTHEAST OF THE SOUTHEAST EDGE OF THE
BH1133'NORTHWEST BRIDGE RAIL.
BH1133
BH1133                          STATION RECOVERY (2006)
BH1133
BH1133'RECOVERY NOTE BY LOUISIANA GEODETIC SURVEY 2006 (JCP)
BH1133'THE STATION IS LOCATED IN ORLEANS PARISH AT CHEF MENTEUR, CHEF MENTEUR
BH1133'PASS, 13 MILES NE OF CHALMETTE, AND 14.3 MILES SSW OF SLIDELL.
BH1133'OWNERSHIP - LADOT - CHEF MENTEUR PASS, HIGHWAY 90 BRIDGE.
BH1133'
BH1133'TO REACH THE STATION FROM THE INTERSECTION OF I-10 AND HIGHWAY 433 IN
BH1133'SLIDELL, GO 6.4 MILES SE ALONG HIGHWAY 433 TO THE JUNCTION OF HIGHWAYS
BH1133'433 AND 406, THENCE 9.67 MILES SW ALONG HIGHWAY 90 TO THE MARK ON THE
BH1133'RIGHT. ALTERNATELY, PROCEED 9.9 MILES NE ALONG HIGHWAY 90 FROM THE
BH1133'INTERSECTION OF I-510 AND HIGHWAY 90 IN MICHOUD. THE STATION IS A
BH1133'BRASS BENCHMARK DISK SET IN CONCRETE BRIDGE DECK AT THE NE END OF THE
BH1133'U.S. HIGHWAY 90 BRIDGE OVER CHEF MENTEUR PASS, 247 FEET SW OF THE NE
BH1133'END OF THE BRIDGE, 9 FEET NW OF THE BRIDGE ROADWAY CENTERLINE, 2.5
BH1133'FEET NE OF THE NE END OF THE STEEL SPAN OF THE BRIDGE, 0.5 FEET SE OF
BH1133'THE SE FACE OF THE NW CONCRETE GUARD RAIL BASE.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
AF9593 ***********************************************************************
AF9593  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
AF9593  CORS         -  This is a GPS Continuously Operating Reference Station.
AF9593  DESIGNATION -  ENGLISH TURN 2 CORS ARP
AF9593  CORS_ID      -  ENG2
AF9593  PID          -  AF9593
AF9593  STATE/COUNTY-  LA/PLAQUEMINES
AF9593  USGS QUAD    -  CHALMETTE (1994)
AF9593
AF9593                         *CURRENT SURVEY CONTROL
AF9593  ___________________________________________________________________
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AF9593* NAD 83(CORS)-  29 52 45.04451(N)    089 56 31.48474(W)     ADJUSTED
AF9593* NAVD 88     -         8.63 **(meters)      28.3  **(feet)  GPS OBS(2004.65)
AF9593  **This station is located in a subsidence area (see below).
AF9593  ___________________________________________________________________
AF9593  EPOCH DATE  -        2002.00
AF9593  X           -       5,595.314 (meters)                     COMP
AF9593  Y           -  -5,534,923.260 (meters)                     COMP
AF9593  Z           -   3,158,759.288 (meters)                     COMP
AF9593  ELLIP HEIGHT-         -17.19  (meters)          (10/??/05) GPS OBS
AF9593  GEOID HEIGHT-         -25.82  (meters)                     GEOID03
AF9593
AF9593  HORZ ORDER  -  SPECIAL (CORS)
AF9593  ELLP ORDER  -  SPECIAL (CORS)
AF9593
AF9593.ITRF positions are available for this station.
AF9593.The coordinates were established by GPS observations
AF9593.and adjusted by the National Geodetic Survey in October 2005..
AF9593.The coordinates are valid at the epoch date displayed above.
AF9593.The epoch date for horizontal control is a decimal equivalence
AF9593.of Year/Month/Day.
AF9593
AF9593 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AF9593 ** and geoid heights are valid at the date of observation. These heights
AF9593 ** must always be validated when used as control.
AF9593 ** The orthometric height was determined by GPS observations using
AF9593 ** precise GPS observation and processing techniques and a new
AF9593 ** realization of GEOID03. It supersedes the leveled height previously
AF9593 ** determined for this station.
AF9593 ** The geoid height was determined by a new realization of GEOID03 for the
AF9593 ** epoch indicated which incorporates improved geoid heights for the
AF9593 ** Southern Louisiana Subsidence area.
AF9593 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AF9593.The orthometric height was determined by GPS observations and a
AF9593.high-resolution geoid model using precise GPS observation and
AF9593.processing techniques.
AF9593
AF9593.The PID for the CORS L1 Phase Center is CQ5984.
AF9593
AF9593.The XYZ, and position/ellipsoidal ht. are equivalent.
AF9593
AF9593.The ellipsoidal height was determined by GPS observations
AF9593.and is referenced to NAD 83.
AF9593
AF9593.The geoid height was determined by GEOID03.
AF9593
AF9593;                    North         East     Units Scale Factor Converg.
AF9593;SPC LA S     -   153,690.042 1,134,386.275   MT  0.99992799   +0 41 44.3
AF9593;SPC LA S     -   504,231.41  3,721,732.30   sFT  0.99992799   +0 41 44.3
AF9593
AF9593!             -  Elev Factor  x  Scale Factor =   Combined Factor
AF9593!SPC LA S     -   1.00000270  x   0.99992799  =   0.99993069
AF9593
AF9593                         SUPERSEDED SURVEY CONTROL
AF9593
AF9593  NAD 83(CORS)-  29 52 45.04458(N)    089 56 31.48453(W) AD(2002.00) c
AF9593  NAD 83(CORS)-  29 52 45.04424(N)    089 56 31.48517(W) AD(2002.00) c
AF9593  ELLIP H (03/??/02)  -17.17   (m)                       GP(2002.00) c c
AF9593  NAD 83(CORS)-  29 52 45.04427(N)    089 56 31.48457(W) AD(1997.00) c
AF9593  NAD 83(CORS)-  29 52 45.04427(N)    089 56 31.48457(W) AD(1996.00) c
AF9593  ELLIP H (08/??/96)  -17.17   (m)                       GP(1997.00) c c
AF9593  ELLIP H (08/??/96)  -17.17   (m)                       GP(1996.00) c c
AF9593
AF9593.Superseded values are not recommended for survey control.
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 AF9593.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 AF9593.See file dsdata.txt to determine how the superseded data were derived.
 AF9593
 AF9593_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU1583709034(NAD 83)
 AF9593_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 AF9593
 AF9593                          STATION DESCRIPTION
 AF9593
 AF9593'DESCRIBED BY NATIONAL GEODETIC SURVEY 2005
 AF9593'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
 AF9593'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
 AF9593'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
 AF9593'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
 AF9593'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AU2028 ***********************************************************************
 AU2028  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AU2028  DESIGNATION -  G 358
 AU2028  PID         -  AU2028
 AU2028  STATE/COUNTY-  LA/LAFOURCHE
 AU2028  USGS QUAD   -  GOLDEN MEADOW (1994)
 AU2028
 AU2028                         *CURRENT SURVEY CONTROL
 AU2028  ___________________________________________________________________
 AU2028* NAD 83(1992)-  29 27 38.86103(N)    090 18 31.16586(W)     ADJUSTED
 AU2028* NAVD 88     -         0.82 **(meters)       2.7  **(feet)  LEVELING(2004.65)
 AU2028  **This station is located in a subsidence area (see below).
 AU2028  **This station is included in the VTDP model (see below).
 AU2028  ___________________________________________________________________
 AU2028  EPOCH DATE  -        2004.65
 AU2028  X           -     -29,940.604 (meters)                     COMP
 AU2028  Y           -  -5,557,796.012 (meters)                     COMP
 AU2028  Z           -   3,118,459.943 (meters)                     COMP
 AU2028  LAPLACE CORR-           0.95  (seconds)                    DEFLEC99
 AU2028  ELLIP HEIGHT-         -23.97  (meters)          (06/22/05) GPS OBS
 AU2028  GEOID HEIGHT-         -24.79  (meters)                     GEOID03
 AU2028  DYNAMIC HT  -           0.82  (meters)       2.7   (feet)  COMP
 AU2028  MODELED GRAV-     979,289.0   (mgal)                       NAVD 88
 AU2028
 AU2028  HORZ ORDER  -  B
 AU2028  VERT ORDER  -  THIRD
 AU2028  ELLP ORDER  -  FOURTH    CLASS I
 AU2028
 AU2028.The horizontal coordinates were established by GPS observations
 AU2028.and adjusted by the National Geodetic Survey in June 2005..
 AU2028.The horizontal coordinates are valid at the epoch date displayed above.
 AU2028.The epoch date for horizontal control is a decimal equivalence
 AU2028.of Year/Month/Day.
 AU2028
 AU2028 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 AU2028 ** and geoid heights are valid at the date of observation. These heights
 AU2028 ** must always be validated when used as control.
 AU2028 ** The orthometric height was determined with a Vertical Time-dependent
 AU2028 ** Positioning (VTDP) model and has been validated through GPS observations
 AU2028 ** for the epoch indicated (see www.ngs.noaa.gov/heightmod/VTDP).
 AU2028 ** The geoid height was determined by a new realization of GEOID03 for the
 AU2028 ** epoch indicated which incorporates improved geoid heights for the
 AU2028 ** Southern Louisiana Subsidence area
 AU2028 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 AU2028.The orthometric height was determined by differential leveling.
 AU2028.The vertical network tie was performed by a horz. field party for horz.
 AU2028.obs reductions. Reset procedures were used to establish the elevation.
 AU2028
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AU2028.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AU2028
AU2028.The Laplace correction was computed from DEFLEC99 derived deflections.
AU2028
AU2028.The ellipsoidal height was determined by GPS observations
AU2028.and is referenced to NAD 83.
AU2028
AU2028.The geoid height was determined by GEOID03.
AU2028
AU2028.The dynamic height is computed by dividing the NAVD 88
AU2028.geopotential number by the normal gravity value computed on the
AU2028.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AU2028.degrees latitude (g = 980.6199 gals.).
AU2028
AU2028.The modeled gravity was interpolated from observed gravity values.
AU2028
AU2028;                    North         East     Units Scale Factor Converg.
AU2028;SPC LA S     -   106,944.590 1,099,392.966   MT  0.99996986   +0 30 44.5
AU2028;SPC LA S     -   350,867.38  3,606,925.09   sFT  0.99996986   +0 30 44.5
AU2028;UTM  15      - 3,262,055.950   761,015.452   MT  1.00044073   +1 19 27.9
AU2028
AU2028!             -  Elev Factor  x  Scale Factor =   Combined Factor
AU2028!SPC LA S     -   1.00000376  x   0.99996986  =   0.99997362
AU2028!UTM  15      -   1.00000376  x   1.00044073  =   1.00044450
AU2028
AU2028                         SUPERSEDED SURVEY CONTROL
AU2028
AU2028  NAVD 88 (02/14/94)    1.005  (m)           3.30   (f) READJUSTED  3
AU2028  NAVD 88 (06/15/91)    1.068  (m)           3.50   (f) UNKNOWN     1 2
AU2028  NGVD 29 (??/??/??)    1.046  (m)           3.43   (f) ADJUSTED    1 2
AU2028
AU2028.Superseded values are not recommended for survey control.
AU2028.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AU2028.See file dsdata.txt to determine how the superseded data were derived.
AU2028
AU2028_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYN6101562056(NAD 83)
AU2028_MARKER: I = METAL ROD
AU2028_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AU2028_SP_SET: STAINLESS STEEL ROD
AU2028_STAMPING: G 358 1982
AU2028_MARK LOGO: NGS
AU2028_PROJECTION: FLUSH
AU2028_MAGNETIC: I = MARKER IS A STEEL ROD
AU2028_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AU2028_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AU2028+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
AU2028_ROD/PIPE-DEPTH: 21.9 meters
AU2028
AU2028  HISTORY     - Date     Condition        Report By
AU2028  HISTORY     - 1982     MONUMENTED       NGS
AU2028  HISTORY     - 19930224 GOOD             NGS
AU2028  HISTORY     - 20040413 GOOD             NGS
AU2028  HISTORY     - 20051010 GOOD             NGS
AU2028  HISTORY     - 20060124 GOOD             3001
AU2028
AU2028                         STATION DESCRIPTION
AU2028
AU2028'DESCRIBED BY NATIONAL GEODETIC SURVEY 1982
AU2028'3.2 KM (2.0 MI) NW FROM GALLIANO.
AU2028'THE MARK IS ABOVE LEVEL WITH HIGHWAY.
AU2028'3.2 KILOMETERS (2.0 MILES) NORTHWEST ALONG STATE HIGHWAY 308 FROM THE
AU2028'JUNCTION OF THE BAYOU BRIDGE AND EAST 128TH STREET IN GALLIANO, TO THE
AU2028'MARK ON THE RIGHT, AT THE SOUTH CORNER OF THE PROPERTY OF THE STAGE
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 AU2028'COACH LOUNGE, 8.53 METERS (28.0 FEET) NORTHEAST OF THE CENTER LINE OF
 AU2028'THE HIGHWAY, 11.07 METERS (36.3 FEET) SOUTH OF THE CORNER OF THE
 AU2028'BUILDING, 0.51 METER (1.7 FEET) WEST OF THE SOUTHWEST END OF A 3-FOOT
 AU2028'HIGH METAL PIPE PROPERTY LINE FENCE, 0.91 METER (3.0 FEET) NORTHWEST
 AU2028'OF A POWER POLE WITH TWO TRANSFORMERS.
 AU2028
 AU2028                          STATION RECOVERY (1993)
 AU2028
 AU2028'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1993
 AU2028'9.3 KM (5.75 MI) NORTHWESTERLY ALONG STATE HIGHWAY 308 FROM THE
 AU2028'JUNCTION OF STATE HIGHWAY 1 IN GOLDEN MEADOW, 11.1 M (36.4 FT)
 AU2028'SOUTHWEST OF THE SOUTH CORNER OF AN ABANDONED BUILDING, 8.5 M (27.9
 AU2028'FT) NORTHEAST OF THE CENTERLINE OF THE HIGHWAY, 0.7 M (2.3 FT)
 AU2028'NORTHWEST OF A UTILITY LIGHT POLE WITH 2 TRANSFORMERS ATTACHED, 0.4 M
 AU2028'(1.3 FT) NORTH-NORTHWEST OF THE SOUTHWEST END OF A FENCE, AND 0.3 M
 AU2028'(1.0 FT) BELOW THE LEVEL OF THE HIGHWAY.  NOTE--ACCESS TO THE DATUM
 AU2028'POINT IS THROUGH A 5-INCH LOGO CAP.
 AU2028
 AU2028                          STATION RECOVERY (2004)
 AU2028
 AU2028'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
 AU2028'RECOVERED AS DESCRIBED
 AU2028
 AU2028                          STATION RECOVERY (2005)
 AU2028
 AU2028'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2005 (KLF)
 AU2028'RECOVERED AS DESCRIBED.
 AU2028
 AU2028                          STATION RECOVERY (2006)
 AU2028
 AU2028'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AU2028'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AU2110 ***********************************************************************
 AU2110  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AU2110  DESIGNATION -  G 365
 AU2110  PID         -  AU2110
 AU2110  STATE/COUNTY-  LA/JEFFERSON
 AU2110  USGS QUAD   -  NEW ORLEANS WEST (1992)
 AU2110
 AU2110                         *CURRENT SURVEY CONTROL
 AU2110  ___________________________________________________________________
 AU2110* NAD 83(1992)-  29 54 39.52074(N)    090 12 46.30724(W)     ADJUSTED
 AU2110* NAVD 88     -         0.24 **(meters)       0.8  **(feet)  GPS OBS(2004.65)
 AU2110  **This station is located in a subsidence area (see below).
 AU2110  ___________________________________________________________________
 AU2110  EPOCH DATE  -        2004.65
 AU2110  X           -     -20,556.547 (meters)                     COMP
 AU2110  Y           -  -5,533,123.639 (meters)                     COMP
 AU2110  Z           -   3,161,810.933 (meters)                     COMP
 AU2110  LAPLACE CORR-          -0.08  (seconds)                    DEFLEC99
 AU2110  ELLIP HEIGHT-         -25.72  (meters)          (06/22/05) GPS OBS
 AU2110  GEOID HEIGHT-         -25.97  (meters)                     GEOID03
 AU2110  DYNAMIC HT  -           0.24  (meters)       0.8   (feet)  COMP
 AU2110  MODELED GRAV-     979,313.4   (mgal)                       NAVD 88
 AU2110  OBS GRAVITY -     979,310.0   (mgal)                       GRAV_OBS
 AU2110
 AU2110  HORZ ORDER  -  B
 AU2110  VERT ORDER  -  FIRST     CLASS II (See Below)
 AU2110  ELLP ORDER  -  FOURTH    CLASS I
 AU2110
 AU2110.The horizontal coordinates were established by GPS observations
 AU2110.and adjusted by the National Geodetic Survey in June 2005..
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AU2110.The horizontal coordinates are valid at the epoch date displayed above.

AU2110.The epoch date for horizontal control is a decimal equivalence
AU2110.of Year/Month/Day.
AU2110
AU2110 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AU2110 ** and geoid heights are valid at the date of observation. These heights
AU2110 ** must always be validated when used as control.
AU2110 ** The orthometric height was determined by GPS observations using
AU2110 ** precise GPS observation and processing techniques and a new
AU2110 ** realization of GEOID03. It supersedes the leveled height previously
AU2110 ** determined for this station.
AU2110 ** The geoid height was determined by a new realization of GEOID03 for the
AU2110 ** epoch indicated which incorporates improved geoid heights for the
AU2110 ** Southern Louisiana Subsidence area.
AU2110 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AU2110.The orthometric height was determined by GPS observations and a
AU2110.high-resolution geoid model using precise GPS observation and
AU2110.processing techniques. It supersedes the leveled height previously
AU2110.determined for this station.
AU2110.The vertical order pertains to the first NAVD 88 superseded value.
AU2110
AU2110.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AU2110
AU2110.The Laplace correction was computed from DEFLEC99 derived deflections.
AU2110
AU2110.The ellipsoidal height was determined by GPS observations
AU2110.and is referenced to NAD 83.
AU2110
AU2110.The geoid height was determined by GEOID03.
AU2110
AU2110.The dynamic height is computed by dividing the NAVD 88
AU2110.geopotential number by the normal gravity value computed on the
AU2110.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AU2110.degrees latitude (g = 980.6199 gals.).
AU2110
AU2110.The modeled gravity was interpolated from observed gravity values.
AU2110.The observed gravity was obtained from relative gravimeter ties
AU2110.to the IGSN71 gravity network.
AU2110
AU2110;                    North         East     Units Scale Factor Converg.
AU2110;SPC LA S     -   156,927.889 1,108,196.737   MT  0.99992697   +0 33 36.9
AU2110;SPC LA S     -   514,854.25  3,635,808.79   sFT  0.99992697   +0 33 36.9
AU2110;UTM  15      - 3,312,186.525   769,106.240   MT  1.00049359   +1 23 26.4
AU2110
AU2110!             -  Elev Factor  x  Scale Factor =   Combined Factor
AU2110!SPC LA S     -   1.00000404  x   0.99992697  =   0.99993101
AU2110!UTM  15      -   1.00000404  x   1.00049359  =   1.00049763
AU2110
AU2110                         SUPERSEDED SURVEY CONTROL
AU2110
AU2110  NAVD 88 (12/05/96)    0.342  (m)           1.12   (f) ADJUSTED    1 2
AU2110  NAVD 88 (02/14/94)    0.313  (m)           1.03   (f) UNKNOWN     1 2
AU2110  NAVD 88 (06/15/91)    0.371  (m)           1.22   (f) UNKNOWN     1 2
AU2110  NGVD 29 (??/??/??)    0.407  (m)           1.34   (f) ADJUSTED    1 2
AU2110
AU2110.Superseded values are not recommended for survey control.
AU2110.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AU2110.See file dsdata.txt to determine how the superseded data were derived.
AU2110
AU2110_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RYP6910612187(NAD 83)
AU2110_MARKER: I = METAL ROD
AU2110_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)
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AU2110_SP_SET: STAINLESS STEEL ROD IN SLEEVE
AU2110_STAMPING: G 365 1984
AU2110_MARK LOGO: NGS
AU2110_PROJECTION: FLUSH
AU2110_MAGNETIC: I = MARKER IS A STEEL ROD
AU2110_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AU2110_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AU2110+SATELLITE: SATELLITE OBSERVATIONS - January 08, 2006
AU2110_ROD/PIPE-DEPTH: 32.9 meters
AU2110_SLEEVE-DEPTH  : 9.10 meters
AU2110
AU2110  HISTORY     - Date     Condition        Report By
AU2110  HISTORY     - 1984     MONUMENTED       NGS
AU2110  HISTORY     - 1984     GOOD             LA-051
AU2110  HISTORY     - 19941122 GOOD             NGS
AU2110  HISTORY     - 20040413 GOOD             NGS
AU2110  HISTORY     - 20060108 GOOD             3001
AU2110
AU2110                          STATION DESCRIPTION
AU2110
AU2110'DESCRIBED BY NATIONAL GEODETIC SURVEY 1984
AU2110'0.24 KM (0.15 MI) WEST FROM AVONDALE.
AU2110'0.24 KM (0.15 MI) WEST ALONG U.S. HIGHWAY 90 FROM THE JUNCTION OF
AU2110'AVONDALE GARDEN ROAD IN AVONDALE.  INSIDE THE ENTRANCE OF THE REST
AU2110'LAWN CEMETARY GROUNDS AND IN THE MIDDLE OF A GRASSY MEDIAN, 3.0 METERS
AU2110'(9.9 FT)NORTH OF THE NORTH FACE OF THE CENTER BRICK PIER OF THE
AU2110'ENTRANCE FENCE, 9.1 METERS (30.0 FT) WEST OF THE CENTER OF A PAVED
AU2110'ENTRANCE ROAD TO THE CEMETARY AND AN IRONGATE, 9.4 METERS (30.7 FT)
AU2110'EAST OF THE CENTER OF A ENTRANCE ROAD AND AN IRONGATE, 4.7 METERS
AU2110'(15.5 FT) SOUTH OF A 4 INCH CEDAR TREE, 24.9 METERS (81.6 FT) SOUTH OF
AU2110'A METAL FLAG POLE, 4.6 METERS (15.2 FT) WEST OF THE WEST FACE OF A 1
AU2110'FOOT HIGH BRICK ENTRANCE FENCE, 5.1 METERS (16.7 FT) EAST OF THE EAST
AU2110'FACE OF A 1 FOOT HIGH ENTRANCE FENCE AND 39.0 METERS (128.0 FT) NORTH
AU2110'OF CENTERLINE OF U.S. HIGHWAY 90 WESTBOUND.   NOTE, DRIVEN TO REQUIRED
AU2110'DRIVING RATE.
AU2110'THE MARK IS 0.15 M ABOVE CEMETARY ENTRANCE ROAD..
AU2110
AU2110                          STATION RECOVERY (1984)
AU2110
AU2110'RECOVERY NOTE BY JEFFERSON PARISH LOUISIANA 1984
AU2110'RECOVERED IN GOOD CONDITION.
AU2110
AU2110                          STATION RECOVERY (1994)
AU2110
AU2110'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
AU2110'5.7 KM (3.55 MI) WESTERLY ALONG U.S. HIGHWAY 90 FROM THE TRAFFIC
AU2110'CIRCLE AT THE SOUTH END OF THE HUEY P LONG BRIDGE IN BRIDGE CITY, 40.5
AU2110'M (132.9 FT) NORTH OF THE CENTERLINE OF THE WESTBOUND LANES OF THE
AU2110'HIGHWAY, 12.0 M (39.4 FT) SOUTH OF A FLAG POLE, 9.3 M (30.5 FT) EAST
AU2110'OF THE CENTER OF A ROAD, 9.2 M (30.2 FT) WEST OF THE CENTER OF THE
AU2110'ENTRANCE TO THE REST LAWN CEMETERY, 3.0 M (9.8 FT) NORTH OF THE NORTH
AU2110'FACE OF A BRICK PILLAR IN THE MEDIAN OF THE ENTRANCE, AND 0.5 M (1.6
AU2110'FT) BELOW THE LEVEL OF THE HIGHWAY.  NOTE--ACCESS TO THE DATUM POINT
AU2110'IS THROUGH A 5-INCH LOGO CAP.
AU2110
AU2110                          STATION RECOVERY (2004)
AU2110
AU2110'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
AU2110'5.7 KM (3.55 MI) WEST ALONG US HWY 90 FROM THE HUEY LONG BRIDGE IN
AU2110'BRIDGE CITY, 0.24KM (0.15  MI) WEST ALONG US 90 FROM THE JUNCTION OF
AU2110'AVONDALE GARDEN ROAD IN AVONDALE.  THE MARK  IS LOCATED INSIDE THE
AU2110'ENTRANCE OF THE REST LAWN CEMENTARY GARDENS IN THE APPROX  CENTER OF
AU2110'THE GRASSY MEDIAN.  THE MARK IS APPROX. 40 MTR N OF THE WEST BOUND
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 AU2110'LANES OF  US 90, IT 10 FT NORTH OF THE FACE OF THE CENTER BRICK
 AU2110'PILLAR, 16 FT ESE OF THE NE CORNER OF  THE NW BRICK PILLAR, 17 FT ENE
 AU2110'OF THE NE CORNER OF THE SW BRICK PILLAR, 16.6 FT WSW OF THE  NW CORNER
 AU2110'OF THE NE BRICK PILLAR, 16.7 FT WNW OF OF THE SW BRICK PILLAR, AND
 AU2110'39.4 FT S OF  THE FLAGPOLE.
 AU2110
 AU2110                          STATION RECOVERY (2006)
 AU2110
 AU2110'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AU2110'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 DH7121 ***********************************************************************
 DH7121  HT_MOD      -  This is a Louisiana Height Modernization Survey Station.
 DH7121  CORS        -  This is a GPS Continuously Operating Reference Station.
 DH7121  DESIGNATION -  GRAND ISLE CORS ARP
 DH7121  CORS_ID     -  GRIS
 DH7121  PID         -  DH7121
 DH7121  STATE/COUNTY-  LA/JEFFERSON
 DH7121  USGS QUAD   -  BARATARIA PASS (1993)
 DH7121
 DH7121                         *CURRENT SURVEY CONTROL
 DH7121  ___________________________________________________________________
 DH7121* NAD 83(CORS)-  29 15 55.88303(N)    089 57 26.26266(W)     ADJUSTED
 DH7121* NAVD 88     -         8.40 **(meters)      27.6  **(feet)  GPS OBS(2004.65)
 DH7121  **This station is located in a subsidence area (see below).
 DH7121  ___________________________________________________________________
 DH7121  EPOCH DATE  -        2002.00
 DH7121  X           -       4,150.421 (meters)                     COMP
 DH7121  Y           -  -5,568,495.489 (meters)                     COMP
 DH7121  Z           -   3,099,600.510 (meters)                     COMP
 DH7121  ELLIP HEIGHT-         -15.60  (meters)          (11/??/05) GPS OBS
 DH7121  GEOID HEIGHT-         -23.99  (meters)                     GEOID03
 DH7121
 DH7121  HORZ ORDER  -  SPECIAL (CORS)
 DH7121  ELLP ORDER  -  SPECIAL (CORS)
 DH7121
 DH7121.ITRF positions are available for this station.
 DH7121.The coordinates were established by GPS observations
 DH7121.and adjusted by the National Geodetic Survey in November 2005..
 DH7121.The coordinates are valid at the epoch date displayed above.
 DH7121.The epoch date for horizontal control is a decimal equivalence
 DH7121.of Year/Month/Day.
 DH7121
 DH7121 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 DH7121 ** and geoid heights are valid at the date of observation. These heights
 DH7121 ** must always be validated when used as control.
 DH7121 ** The orthometric height was determined by GPS observations using
 DH7121 ** precise GPS observation and processing techniques and a new
 DH7121 ** realization of GEOID03. It supersedes the leveled height previously
 DH7121 ** determined for this station.
 DH7121 ** The geoid height was determined by a new realization of GEOID03 for the
 DH7121 ** epoch indicated which incorporates improved geoid heights for the
 DH7121 ** Southern Louisiana Subsidence area.
 DH7121 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 DH7121.The orthometric height was determined by GPS observations and a
 DH7121.high-resolution geoid model using precise GPS observation and
 DH7121.processing techniques.
 DH7121
 DH7121.The PID for the CORS L1 Phase Center is DH7122.
 DH7121
 DH7121.The XYZ, and position/ellipsoidal ht. are equivalent.
 DH7121
 DH7121.The ellipsoidal height was determined by GPS observations
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DH7121.and is referenced to NAD 83.
DH7121
DH7121.The geoid height was determined by GEOID03.
DH7121
DH7121;                    North         East     Units Scale Factor Converg.
DH7121;SPC LA S     -    85,659.175 1,133,733.344   MT  1.00000748   +0 41 16.9
DH7121;SPC LA S     -   281,033.48  3,719,590.15   sFT  1.00000748   +0 41 16.9
DH7121
DH7121!             -  Elev Factor  x  Scale Factor =   Combined Factor
DH7121!SPC LA S     -   1.00000245  x   1.00000748  =   1.00000993
DH7121
DH7121                         SUPERSEDED SURVEY CONTROL
DH7121
DH7121.No superseded survey control is available for this station.
DH7121
DH7121_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBT1263241031(NAD 83)
DH7121_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
DH7121
DH7121                         STATION DESCRIPTION
DH7121
DH7121'DESCRIBED BY NATIONAL GEODETIC SURVEY 2005
DH7121'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DH7121'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DH7121'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DH7121'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DH7121'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
AT0200 ***********************************************************************
AT0200  HT_MOD      -  This is a Louisiana Height Modernization Survey Station.
AT0200  DESIGNATION -  MILAN 2
AT0200  PID         -  AT0200
AT0200  STATE/COUNTY-  LA/PLAQUEMINES
AT0200  USGS QUAD   -  PORT SULPHUR (1993)
AT0200
AT0200                        *CURRENT SURVEY CONTROL
AT0200  ___________________________________________________________________
AT0200* NAD 83(1992)-  29 28 05.74368(N)    089 40 53.72992(W)     ADJUSTED
AT0200* NAVD 88     -        -0.15 **(meters)      -0.5  **(feet)  GPS OBS(2004.65)
AT0200  **This station is located in a subsidence area (see below).
AT0200  ___________________________________________________________________
AT0200  EPOCH DATE  -        2004.65
AT0200  X           -      30,884.220 (meters)                     COMP
AT0200  Y           -  -5,557,383.217 (meters)                     COMP
AT0200  Z           -   3,119,180.322 (meters)                     COMP
AT0200  LAPLACE CORR-           0.43  (seconds)                    DEFLEC99
AT0200  ELLIP HEIGHT-         -24.53  (meters)         (06/22/05) GPS OBS
AT0200  GEOID HEIGHT-         -24.39  (meters)                     GEOID03
AT0200  DYNAMIC HT  -          -0.15  (meters)      -0.5   (feet)  COMP
AT0200  MODELED GRAV-     979,306.4   (mgal)                       NAVD 88
AT0200
AT0200  HORZ ORDER  -  B
AT0200  VERT ORDER  -  THIRD (See Below)
AT0200  ELLP ORDER  -  FOURTH    CLASS I
AT0200
AT0200.The horizontal coordinates were established by GPS observations
AT0200.and adjusted by the National Geodetic Survey in June 2005..
AT0200.The horizontal coordinates are valid at the epoch date displayed above.
AT0200.The epoch date for horizontal control is a decimal equivalence
AT0200.of Year/Month/Day.
AT0200
AT0200 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AT0200 ** and geoid heights are valid at the date of observation. These heights
AT0200 ** must always be validated when used as control.
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AT0200 ** The orthometric height was determined by GPS observations using
AT0200 ** precise GPS observation and processing techniques and a new
AT0200 ** realization of GEOID03. It supersedes the leveled height previously
AT0200 ** determined for this station.
AT0200 ** The geoid height was determined by a new realization of GEOID03 for the
AT0200 ** epoch indicated which incorporates improved geoid heights for the
AT0200 ** Southern Louisiana Subsidence area.
AT0200 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AT0200.The orthometric height was determined by GPS observations and a
AT0200.high-resolution geoid model using precise GPS observation and
AT0200.processing techniques. It supersedes the leveled height previously
AT0200.determined for this station.
AT0200.WARNING-GPS observations at this control monument resulted in a GPS
AT0200.derived orthometric height which differed from the leveled height by
AT0200.more than one decimeter (0.1 meter).
AT0200.The vertical order pertains to the first NAVD 88 superseded value.
AT0200
AT0200.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AT0200
AT0200.The Laplace correction was computed from DEFLEC99 derived deflections.
AT0200
AT0200.The ellipsoidal height was determined by GPS observations
AT0200.and is referenced to NAD 83.
AT0200
AT0200.The geoid height was determined by GEOID03.
AT0200
AT0200.The dynamic height is computed by dividing the NAVD 88
AT0200.geopotential number by the normal gravity value computed on the
AT0200.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AT0200.degrees latitude (g = 980.6199 gals.).
AT0200
AT0200.The modeled gravity was interpolated from observed gravity values.
AT0200
AT0200;                    North         East     Units Scale Factor Converg.
AT0200;SPC LA S     -   108,482.520 1,160,202.601   MT  0.99996865   +0 49 33.2
AT0200;SPC LA S     -   355,913.07  3,806,431.37   sFT  0.99996865   +0 49 33.2
AT0200;UTM  16      - 3,262,861.970   239,949.682   MT  1.00043452   -1 19 11.7
AT0200

AT0200!             -  Elev Factor  x  Scale Factor =   Combined Factor
AT0200!SPC LA S     -   1.00000385  x   0.99996865  =   0.99997250
AT0200!UTM  16      -   1.00000385  x   1.00043452  =   1.00043837
AT0200
AT0200:                Primary Azimuth Mark                          Grid Az
AT0200:SPC LA S     -  MILAN 2 AZ MK                                 322 05 29.7
AT0200:UTM  16      -  MILAN 2 AZ MK                                 324 14 14.6
AT0200
AT0200|---------------------------------------------------------------------|
AT0200| PID    Reference Object                     Distance      Geod. Az  |
AT0200|                                                           dddmmss.s |
AT0200| AT0202 MILAN 2 RM 1                          39.715 METERS 13301     |
AT0200| AT0201 MILAN 2 RM 2                          27.150 METERS 17659     |
AT0200| AT1151 PORT SULPHUR FREEPORT CO STACK      APPROX. 0.7 KM 2490755.2 |
AT0200| AT1157 FREEPORT SULPHUR CO WATER TANK      APPROX. 0.9 KM 2941510.4 |
AT0200| DD7445 MILAN 2 AZ MK                                      3225502.9 |
AT0200|---------------------------------------------------------------------|
AT0200
AT0200                          SUPERSEDED SURVEY CONTROL
AT0200
AT0200  NAD 83(1992)-  29 28 05.73772(N)    089 40 53.72090(W) AD(       ) 2
AT0200  NAD 83(1986)-  29 28 05.74729(N)    089 40 53.72727(W) AD(       ) 2
AT0200  NAD 27      -  29 28 04.96471(N)    089 40 53.50130(W) AD(       ) 2
AT0200  NAVD 88 (02/14/94)    0.005  (m)            0.02   (f) READJUSTED  3
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AT0200  NAVD 88 (06/15/91)    0.061  (m)            0.20   (f) UNKNOWN     1 1
AT0200  NGVD 29 (??/??/??)    0.092  (m)            0.30   (f) ADJUSTED    1 1
AT0200
AT0200.Superseded values are not recommended for survey control.
AT0200.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AT0200.See file dsdata.txt to determine how the superseded data were derived.
AT0200
AT0200_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBT3995062862(NAD 83)
AT0200_MARKER: DS = TRIANGULATION STATION DISK
AT0200_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AT0200_SP_SET: SET IN TOP OF CONCRETE MONUMENT
AT0200_STAMPING: MILAN 2 1966
AT0200_MARK LOGO: CGS
AT0200_MAGNETIC: N = NO MAGNETIC MATERIAL
AT0200_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AT0200+STABILITY: SURFACE MOTION
AT0200_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AT0200+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
AT0200
AT0200  HISTORY     - Date     Condition        Report By
AT0200  HISTORY     - 1966     MONUMENTED       CGS
AT0200  HISTORY     - 1971     GOOD             USGS
AT0200  HISTORY     - 1971     GOOD             NGS
AT0200  HISTORY     - 1984     GOOD             NGS

AT0200  HISTORY     - 20040419 GOOD             NGS
AT0200  HISTORY     - 20051007 GOOD             NGS
AT0200  HISTORY     - 20060124 GOOD             3001
AT0200
AT0200                          STATION DESCRIPTION
AT0200
AT0200'DESCRIBED BY COAST AND GEODETIC SURVEY 1966 (LMC)
AT0200'STATION IS LOCATED IN PORT SULPHUR, IS IN THE SOUTHEASTERLY CORNER
AT0200'OF GOLF COURSE
AT0200'BELONGING TO FREEPORT SULPHUR COMPANY AND JUST NORTHWEST
AT0200'OF DELTA BANK AND TRUST COMPANY
AT0200'BUILDING.
AT0200'
AT0200'TO REACH FROM THE FREEPORT SULPHUR COMPANY MAIN OFFICE IN PORT
AT0200'SULPHUR, GO
AT0200'SOUTHEAST ON STATE HIGHWAY 23 FOR 0.9 MILE TO SIDE ROAD
AT0200'RIGHT AND STATION AS
AT0200'DESCRIBED.
AT0200'
AT0200'STATION MARK, A STANDARD DISK STAMPED MILAN 2 1966, IS SET IN
AT0200'THE TOP OF A
AT0200'CONCRETE CYLINDER WHICH IS SET FLUSH WITH GROUND.  THE MARK
AT0200'IS 88 FEET SOUTHWEST OF CENTER
AT0200'OF STATE HIGHWAY 23, 52.5 FEET SOUTH
AT0200'OF THE SOUTHEAST CORNER OF ELEVATED GOLF GREEN,
AT0200'47.5 FEET WEST OF TREE,
AT0200'51 FEET NORTHWEST OF CENTER OF ROAD AND 28 FEET NORTHWEST OF
AT0200'FENCE.
AT0200'
AT0200'REFERENCE MARK 1, A STANDARD DISK STAMPED MILAN 2 NO 1 1966, IS
AT0200'SET IN THE TOP OF
AT0200'A CONCRETE CYLINDER WHICH IS SET FLUSH.  THE MARK IS
AT0200'34 FEET SOUTHEAST OF CENTER OF ROAD,
AT0200'5 FEET WEST OF THE NORTHWEST
AT0200'CORNER OF DELTA BANK AND LOAN BUILDING AND 3.5 FEET
AT0200'NORTHWEST OF THE
AT0200'NORTHWEST SIDE OF BANK BUILDING.
AT0200'
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AT0200'REFERENCE MARK 2, A STANDARD DISK STAMPED MILAN 2 NO 2 1966, IS
AT0200'SET IN THE TOP OF
AT0200'A CONCRETE CYLINDER WHICH IS SET FLUSH WITH THE
AT0200'GROUND.  THE MARK IS 36 FEET
AT0200'SOUTHEAST OF CENTER OF ROAD, 20 FEET NORTHEAST
AT0200'OF CENTER OF REAR DRIVEWAY AND 6 FEET NORTH OF
AT0200'THE NORTHWEST
AT0200'CORNER OF DELTA BANK AND TRUST BUILDING.
AT0200'
AT0200'AZIMUTH MARK, A STANDARD DISK STAMPED MILAN 2 1966, IS SET IN
AT0200'THE TOP OF A
AT0200'CONCRETE CYLINDER WHICH IS PROJECTING ABOUT 2 INCHES.  THE
AT0200'MARK IS 88.5 FEET NORTHEAST OF
AT0200'CENTER OF STATE HIGHWAY 23, 44.5 FEET
AT0200'SOUTH OF THE SOUTH PIPE OF A GROUP OF PIPES, 36
AT0200'FEET EAST OF POWER
AT0200'POLE, 15 FEET SOUTHWEST OF CENTER OF LEVEE AND 2.3 FEET SOUTHEAST
AT0200'OF WITNESS POST.
AT0200'
AT0200'TO REACH AZIMUTH MARK FROM STATION, GO NORTHWEST ON STATE HIGHWAY
AT0200'23 FOR 0.3 MILE TO
AT0200'WHERE PIPES CROSS OVER ROAD AND AZIMUTH MARK ON RIGHT.
AT0200'
AT0200'DISTANCE BETWEEN REFERENCE MARK 1 AND 2 IS 90.57 FEET OR 27.603
AT0200'METERS.
AT0200'
AT0200'HEIGHT OF LIGHT ABOVE STATION MARK 30 METERS.
AT0200
AT0200                          STATION RECOVERY (1971)
AT0200
AT0200'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1971 (JDS)
AT0200'MILAN 2 AND RM 1 AND 2 FOUND IN GOOD CONDITION. AZ. MK. NOT FOUND.
AT0200'DISTANCES AND DIRECTIONS CHECKED OK.  ORIGINAL DESCRIPTION IS
AT0200'ADEQUATE.
AT0200
AT0200                          STATION RECOVERY (1971)
AT0200
AT0200'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1971
AT0200'1.1 MI SE FROM PORT SULPHUR.
AT0200'ABOUT 1.1 MILES SOUTHEAST ALONG STATE HIGHWAY 23 FROM THE FIRE STATION
AT0200'AND CEMETERY AT PORT SULPHUR, NEAR THE EAST CORNER OF A GOLF COURSE,
AT0200'88 FEET SOUTHWEST OF THE CENTER LINE OF THE HIGHWAY, 53 FEET NORTHWEST
AT0200'OF THE CENTER LINE OF A DRIVEWAY WHICH LEADS SOUTHWEST ALONG THE
AT0200'NORTHWEST SIDE OF THE DELTA STATE BANK AND TRUST COMPANY BUILDING, 59
AT0200'FEET SOUTHWEST OF A FIRE HYDRANT, 47 1/2 FEET WEST OF A 12-INCH OAK
AT0200'TREE, 54 1/2 FEET NORTH OF A 14-INCH OAK TREE, 28 FEET NORTHWEST OF A
AT0200'ROW OF CONCRETE FILLED 3-INCH METAL PIPES THAT PROJECT 2 FEET, ABOUT
AT0200'LEVEL WITH THE DRIVEWAY, ABOUT 1 FOOT BELOW THE LEVEL OF THE HIGHWAY,
AT0200'AND SET IN THE TOP OF A CONCRETE POST WHICH IS 0.1 FOOT BELOW THE
AT0200'SURFACE OF THE GROUND.
AT0200
AT0200                          STATION RECOVERY (1984)
AT0200
AT0200'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1984
AT0200'RECOVERED IN GOOD CONDITION.
AT0200
AT0200                          STATION RECOVERY (2004)
AT0200
AT0200'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
AT0200'THE STATION IS LOCATED IN PORT SULPER NEAR THE SOUTHEAST CORNER OF THE
AT0200'PORT SULPHER GOLF  COURSE.  OWNERSHIP--PLAQUEMINES PARISH RECREATIONAL
AT0200'DEPARTMENT.
AT0200'
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 AT0200'TO REACH THE STATION FROM THE POST OFFICE IN PORT SULPHER GO SOUTHERLY
 AT0200'FOR 3.2 MI ON STATE  HIGHWAY 23 TO THE STATION ON THE RIGHT NEAR THE
 AT0200'SOUTEAST CORNER OF THE PORT SULPHER GOLF  COURSE, JUST BEFORE REACHING
 AT0200'A GRAVEL ENTRANCE WAY TO THE REGIONS BANK PARKING LOT ON THE  RIGHT.
 AT0200'
 AT0200'THE STATION IS LOCATED 22.8 M SOUTHWESTR OF THE SOUTHWEST EDGE OF THE
 AT0200'HIGHWAY, 19.1 M SOUTH OF  THE SOUTHERN MOST 1 OF 2 SUPPORT POSTS FOR A
 AT0200'GOLF COURSE SIGN, 10.0 M NORTH OF THE NORTHEAST  END OF A CHAIN LINK
 AT0200'FENCE, 9.6 M NORTHWEST OF THE NORTHWEST EDGE OF THE REGIONS BANK
 AT0200'PARKING  LOT, AND ABOUT 0.3 M BELOW THE LEVEL OF THE HIGHWAY.
 AT0200
 AT0200                          STATION RECOVERY (2005)
 AT0200
 AT0200'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2005 (KLF)
 AT0200'RECOVERED AS DESCRIBED WITH THE FOLLOWING CHANGES.  0.65 M SE OF A
 AT0200'METAL POST WITH WITNESS SIGN ATTACHED.  NOTE--THE GOLF COURSE SIGN
 AT0200'PREVIOUSLY REFERENCED TO IS MISSING BUT THE SIGN POST IS INTACT.
 AT0200'NOTE--THE BANK BUILDING PREVIOUSLY REFERENCED TO WAS SEVERELY DAMAGED
 AT0200'BY HURRICANE KATRINA.
 AT0200
 AT0200                          STATION RECOVERY (2006)
 AT0200
 AT0200'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AT0200'THE STATION IS LOCATED IN PORT SULPHUR IN THE NORTHEAST CORNER OF A
 AT0200'GOLF COURSE, 5 MILES NW OF NAIRN AND 5 MILES SE OF HAPPY JACK ON STATE
 AT0200'HIGHWAY 23.  OWNERSHIP - PLAQUEMINES PARISH RECREATIONAL DEPARTMENT.
 AT0200'TO REACH THE STATION FROM THE POST OFFICE IN PORT SULPHUR, GO SE 3.2
 AT0200'MILES ON STATE HIGHWAY 23 TO THE STATION ON THE RIGHT.  FOR REFERENCE,
 AT0200'THE FREEPORT SULPHUR COMPANY, MAIN OFFICE, IS 0.9 MILES NW OF THE
 AT0200'MARK. THE STATION IS A BRASS DISK SET IN CONCRETE, STAMPED MILAN 2
 AT0200'1966, 88 FEET SW OF THE CENTERLINE OF HIGHWAY 23, 52.5 FEET SOUTH OF
 AT0200'THE SE CORNER OF AN ELEVATED GOLF GREEN, 47.5 FEET WEST OF AN OAK
 AT0200'TREE, 51 FEET NW OF A ROAD ON THE WEST SIDE OF THE DELTA STATE BANK.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 BH1160 ***********************************************************************
 BH1160  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 BH1160  TIDAL BM     -  This is a Tidal Bench Mark.
 BH1160  DESIGNATION -  PIKE RM 3
 BH1160  PID          -  BH1160
 BH1160  STATE/COUNTY-  LA/ORLEANS
 BH1160  USGS QUAD   -  RIGOLETS (1993)
 BH1160
 BH1160                         *CURRENT SURVEY CONTROL
 BH1160  ___________________________________________________________________
 BH1160* NAD 83(1992)-  30 09 59.48640(N)    089 44 15.40588(W)     ADJUSTED
 BH1160* NAVD 88     -         2.80 **(meters)       9.2  **(feet)  GPS OBS(2004.65)
 BH1160  **This station is located in a subsidence area (see below).
 BH1160  ___________________________________________________________________
 BH1160  EPOCH DATE  -       2004.65
 BH1160  X           -      25,274.213 (meters)                     COMP
 BH1160  Y           -  -5,518,925.102 (meters)                     COMP
 BH1160  Z           -   3,186,335.043 (meters)                     COMP
 BH1160  LAPLACE CORR-          -0.37  (seconds)                    DEFLEC99
 BH1160  ELLIP HEIGHT-         -23.75  (meters)         (04/11/06) GPS OBS
 BH1160  GEOID HEIGHT-         -26.57  (meters)                     GEOID03
 BH1160  DYNAMIC HT  -           2.80  (meters)       9.2   (feet)  COMP
 BH1160  MODELED GRAV-     979,331.2   (mgal)                       NAVD 88
 BH1160  OBS GRAVITY -     979,332.1   (mgal)                       GRAV_OBS
 BH1160
 BH1160  HORZ ORDER  -  B
 BH1160  VERT ORDER  -  FIRST     CLASS I (See Below)
 BH1160  ELLP ORDER  -  FOURTH    CLASS II
 BH1160
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BH1160.The horizontal coordinates were established by GPS observations
BH1160.and adjusted by the National Geodetic Survey in April 2006..
BH1160.The horizontal coordinates are valid at the epoch date displayed above.
BH1160.The epoch date for horizontal control is a decimal equivalence
BH1160.of Year/Month/Day.
BH1160
BH1160 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH1160 ** and geoid heights are valid at the date of observation. These heights
BH1160 ** must always be validated when used as control.
BH1160 ** The orthometric height was determined by GPS observations using
BH1160 ** precise GPS observation and processing techniques and a new
BH1160 ** realization of GEOID03. It supersedes the leveled height previously
BH1160 ** determined for this station.
BH1160 ** The geoid height was determined by a new realization of GEOID03 for the
BH1160 ** epoch indicated which incorporates improved geoid heights for the
BH1160 ** Southern Louisiana Subsidence area.
BH1160 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH1160.The orthometric height was determined by GPS observations and a
BH1160.high-resolution geoid model using precise GPS observation and
BH1160.processing techniques. It supersedes the leveled height previously
BH1160.determined for this station.
BH1160.WARNING-GPS observations at this control monument resulted in a GPS
BH1160.derived orthometric height which differed from the leveled height by
BH1160.more than one decimeter (0.1 meter).
BH1160.The vertical order pertains to the first NAVD 88 superseded value.
BH1160
BH1160.This Tidal Bench Mark is designated as VM 7156
BH1160.by the Center for Operational Oceanographic Products and Services.
BH1160
BH1160.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH1160
BH1160.The Laplace correction was computed from DEFLEC99 derived deflections.
BH1160
BH1160.The ellipsoidal height was determined by GPS observations
BH1160.and is referenced to NAD 83.
BH1160
BH1160.The geoid height was determined by GEOID03.
BH1160
BH1160.The dynamic height is computed by dividing the NAVD 88
BH1160.geopotential number by the normal gravity value computed on the
BH1160.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH1160.degrees latitude (g = 980.6199 gals.).
BH1160
BH1160.The modeled gravity was interpolated from observed gravity values.
BH1160.The observed gravity was obtained from relative gravimeter ties
BH1160.to the IGSN71 gravity network.
BH1160
BH1160;                    North         East     Units Scale Factor Converg.
BH1160;SPC LA S     -   185,795.039 1,153,691.697   MT  0.99992991   +0 47 52.4
BH1160;SPC LA S     -   609,562.56  3,785,070.18   sFT  0.99992991   +0 47 52.4
BH1160;SPC MS E     -    74,225.675   212,898.034   MT  1.00004357   -0 27 16.0

BH1160;SPC MS E     -   243,522.07    698,482.97   sFT  1.00004357   -0 27 16.0
BH1160;UTM  16      - 3,340,404.411   236,355.514   MT  1.00045763   -1 22 35.3
BH1160
BH1160!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH1160!SPC LA S     -   1.00000373  x   0.99992991  =   0.99993364
BH1160!SPC MS E     -   1.00000373  x   1.00004357  =   1.00004730
BH1160!UTM  16      -   1.00000373  x   1.00045763  =   1.00046136
BH1160
BH1160                         SUPERSEDED SURVEY CONTROL
BH1160
BH1160  NAD 83(1992)-  30 09 59.48574(N)    089 44 15.40419(W) AD(       ) 2
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BH1160  NAD 83(1992)-  30 09 59.48860(N)    089 44 15.40340(W) AD(       ) 2
BH1160  NAD 83(1986)-  30 09 59.49961(N)    089 44 15.40082(W) AD(       ) 2
BH1160  NAD 27      -  30 09 58.79300(N)    089 44 15.18100(W) AD(       ) 2
BH1160  NAVD 88 (12/05/96)    2.929  (m)           9.61   (f) ADJUSTED    1 1
BH1160  NAVD 88 (02/14/94)    2.930  (m)           9.61   (f) UNKNOWN     1 1
BH1160  NAVD 88 (06/15/91)    2.938  (m)           9.64   (f) UNKNOWN     1 1
BH1160  NGVD 29 (05/21/91)    2.993  (m)           9.82   (f) ADJUSTED    1 1
BH1160
BH1160.Superseded values are not recommended for survey control.
BH1160.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH1160.See file dsdata.txt to determine how the superseded data were derived.
BH1160
BH1160_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU3635640404(NAD 83)
BH1160_MARKER: DR = REFERENCE MARK DISK
BH1160_SETTING: 35 = SET IN A MAT FOUNDATION OR CONCRETE SLAB OTHER THAN
BH1160+WITH SETTING: PAVEMENT
BH1160_SP_SET: DISK CENTERED ON A RED CONCRETE
BH1160_STAMPING: PIKE NO 3 1952
BH1160_MARK LOGO: CGS
BH1160_MAGNETIC: N = NO MAGNETIC MATERIAL
BH1160_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
BH1160+STABILITY: SURFACE MOTION
BH1160_SATELLITE: THE SITE LOCATION WAS REPORTED AS NOT SUITABLE FOR
BH1160+SATELLITE: SATELLITE OBSERVATIONS - January 06, 2006
BH1160
BH1160  HISTORY     - Date     Condition        Report By
BH1160  HISTORY     - 1952     MONUMENTED       CGS
BH1160  HISTORY     - 1954     GOOD             CGS
BH1160  HISTORY     - 1963     GOOD             CGS
BH1160  HISTORY     - 1969     GOOD             CGS
BH1160  HISTORY     - 1970     GOOD             NGS
BH1160  HISTORY     - 1977     GOOD             NGS
BH1160  HISTORY     - 1980     GOOD             LADTD
BH1160  HISTORY     - 1984     GOOD             LA-051
BH1160  HISTORY     - 1985     GOOD             NGS
BH1160  HISTORY     - 1986     GOOD             NGS
BH1160  HISTORY     - 19901022 GOOD             NGS
BH1160  HISTORY     - 19930317 GOOD             NGS
BH1160  HISTORY     - 19941018 GOOD             NGS
BH1160  HISTORY     - 20060106 GOOD             3001
BH1160
BH1160                          STATION DESCRIPTION
BH1160
BH1160'DESCRIBED BY COAST AND GEODETIC SURVEY 1952 (PLB)
BH1160'THE STATION IS LOCATED ABOUT 8 MILES SE. OF SLIDELL NEAR THE S. END
BH1160'OF THE NEW RIGOLETS BRIDGE ON U.S. HIGHWAY 90 ON THE LAWN OF THE OLD
BH1160'FORT PIKE AND BETWEEN THE MOAT OF THE FORT AND THE HIGHWAY. A
BH1160'STANDARD CAA 36 INCH ROTATING AIRWAY BEACON FLASHING RED AND
BH1160'WHITE, MOUNTED ON A STEEL FRAME TOWER AND ABOUT 70 FEET HIGH.
BH1160'
BH1160'PIKE RM NO. 3 1952 WAS ESTABLISHED IN THE CONCRETE FOUNDATION OF THE
BH1160'BEACON, DIRECTLY UNDER THE BEACON LIGHT.
BH1160'
BH1160'THE BEACON IS CALLED NEW ORLEANS-ATLANTA AIRWAY BEACON NO. 2.
BH1160
BH1160                          STATION RECOVERY (1954)
BH1160
BH1160'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1954 (RAE)
BH1160'THE ORIGINAL DESCRIPTION IS ADEQUATE.
BH1160
BH1160                          STATION RECOVERY (1963)
BH1160
BH1160'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1963 (RRG)
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BH1160'THE STEEL TOWER SUPPORTING THE BEACON LIGHT OVER R.M. 3 FOR PIKE HAS
BH1160'BEEN TORN DOWN BUT THE CONCRETE BASE REMAINS AND THE MARK HAS NOT
BH1160'BEEN DISTURBED.
BH1160
BH1160                          STATION RECOVERY (1969)
BH1160
BH1160'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1969
BH1160'23.2 MI E FROM NEW ORLEANS.
BH1160'ABOUT 23.2 MILES EAST ALONG U. S. HIGHWAY 90 FROM THE I 10 OVERPASS
BH1160'OVER U. S. HIGHWAY 90 AT NEW ORLEANS, AT OLD FORT PIKE, 67.5 FEET WEST
BH1160'OF THE STATION MARK, SET ON THE TOP AND ABOUT IN THE CENTER OF A 13
BH1160'1/2 FOOT SQUARE CONCRETE BLOCK WHICH FORMERLY SUPPORTED A BEACON
BH1160'LIGHT, 113 FEET SOUTHEAST OF THE CENTER LINE OF THE HIGHWAY, 83 FEET
BH1160'SOUTH OF BENCH MARK C 193 DESCRIBED AND ABOUT LEVEL WITH THE HIGHWAY.
BH1160
BH1160                          STATION RECOVERY (1970)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1970
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1977)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1977
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1980)
BH1160
BH1160'RECOVERY NOTE BY LA TRANSP AND DEV 1980
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1984)
BH1160
BH1160'RECOVERY NOTE BY JEFFERSON PARISH LOUISIANA 1984
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1985)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1985
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1986)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986
BH1160'RECOVERED IN GOOD CONDITION.
BH1160
BH1160                          STATION RECOVERY (1990)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
BH1160'37.4 KM (23.2 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1160'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS,
BH1160'AT FORT PIKE HISTORICAL SITE, IN THE CENTER OF A 4.1 M (13.5 FT)
BH1160'SQUARE CONCRETE BLOCK WHICH FORMERLY SUPPORTED A BEACON, 34.4 M
BH1160'(112.9 FT) SOUTHEAST OF THE HIGHWAY CENTERLINE, 20.5 M (67.3 FT) WEST
BH1160'OF TRIANGULATION STATION PIKE, 0.6 M (2.0 FT) ABOVE THE GROUND
BH1160'SURFACE, AND LEVEL WITH THE HIGHWAY.
BH1160
BH1160                          STATION RECOVERY (1993)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1993
BH1160'37.4 KM (23.25 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1160'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS,
BH1160'NEAR THE CENTER OF A 12 BY 12-FOOT CONCRETE PAD THAT FORMERLY
BH1160'SUPPORTED A BEACON, 34.8 M (114.2 FT) SOUTHEAST OF AND LEVEL WITH THE
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BH1160'CENTERLINE OF THE HIGHWAY, 25.5 M (83.7 FT) SOUTH OF BENCH MARK C
BH1160'193, 24.7 M (81.0 FT) SOUTH-SOUTHEAST OF A WITNESS POST, 20.5 M (67.3
BH1160'FT) WEST OF TRIANGULATION STATION PIKE RESET, 19.4 M (63.6 FT)
BH1160'SOUTHEAST OF A CHAIN-LINK FENCE, AND 2.9 M (9.5 FT) NORTHEAST OF THE
BH1160'SOUTHWEST CORNER OF THE PAD.
BH1160
BH1160                          STATION RECOVERY (1994)
BH1160
BH1160'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
BH1160'37.0 KM (23.00 MI) EASTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR
BH1160'HIGHWAY) FROM THE JUNCTION OF INTERSTATE HIGHWAY 10 IN NEW ORLEANS,
BH1160'NEAR THE CENTER OF A 12 BY 12-FOOT CONCRETE PAD THAT FORMERLY
BH1160'SUPPORTED A BEACON, 34.8 M (114.2 FT) SOUTHEAST OF AND LEVEL WITH THE
BH1160'HIGHWAY CENTERLINE, 25.5 M (83.7 FT) SOUTH OF BENCH MARK C 193, 24.7 M
BH1160'(81.0 FT) SOUTH-SOUTHEAST OF A WITNESS POST, 20.5 M (67.3 FT) WEST OF
BH1160'TRIANGULATION STATION PIKE RESET, 19.4 M (63.6 FT) SOUTHEAST OF A
BH1160'CHAIN-LINK FENCE, AND 2.9 M (9.5 FT) NORTHEAST OF THE SOUTHWEST CORNER
BH1160'OF THE PAD.
BH1160
BH1160                          STATION RECOVERY (2006)
BH1160
BH1160'RECOVERY NOTE BY 3001, INC 2006 (JCP)
BH1160'THE STATION IS LOCATED IN ORLEANS PARISH AT FORT PIKE ON THE WEST END
BH1160'OF THE RIGOLETTS BRIDGE 8.0 MILES SE OF SLIDELL. OWNERSHIP - LADOT
BH1160'
BH1160'TO REACH THE STATION FROM THE INTERSECTION OF I-10, EXIT 263, AND
BH1160'HIGHWAY 433 IN SLIDELL, GO 6.5 MILES SE ALONG HIGHWAY 433 TO THE
BH1160'JUNCTION OF HIGHWAY 90, TURN RIGHT ON HIGHWAY 90 AND GO  0.95  MILES,
BH1160'CROSSING THE RIGOLETTS BRIDGE TO THE MARK ON THE SOUTH SIDE OF HIGHWAY
BH1160'90. THE STATION IS A BRASS DISK SET IN THE CENTER OF A RED CONCRETE
BH1160'PAD, 114.2 FEET SE OF THE HIGHWAY 90 CENTERLINE,83.7 FEET SOUTH OF THE
BH1160'BENCHMARK C 193, 67.3 FEET WEST OF TRIANGULATION STATION PIKE RESET,
BH1160'9.5 FEET NE OF THE SW CORNER OF THE RED CONCRETE PAD. NOTE THE FENCE
BH1160'MENTIONED IN THE PREVIOUS DESCRIPTIONS WAS DESTROYED DURING THE
BH1160'KATRINA STORM.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
AT0804 ***********************************************************************
AT0804  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
AT0804  FBN          -  This is a Federal Base Network Control Station.
AT0804  DESIGNATION -  REGGIO 2
AT0804  PID          -  AT0804
AT0804  STATE/COUNTY-  LA/ST BERNARD
AT0804  USGS QUAD    -  DELACROIX (1994)
AT0804
AT0804                         *CURRENT SURVEY CONTROL
AT0804  ___________________________________________________________________
AT0804* NAD 83(1992)-  29 50 40.71916(N)    089 45 32.43079(W)     ADJUSTED
AT0804* NAVD 88      -         1.52 **(meters)       5.0  **(feet)  GPS OBS(2004.65)
AT0804  **This station is located in a subsidence area (see below).
AT0804  ___________________________________________________________________
AT0804  EPOCH DATE   -       2004.65
AT0804  X            -      23,288.344 (meters)                     COMP
AT0804  Y            -  -5,536,777.168 (meters)                     COMP
AT0804  Z            -   3,155,435.922 (meters)                     COMP
AT0804  LAPLACE CORR-          -0.03  (seconds)                     DEFLEC99
AT0804  ELLIP HEIGHT-         -24.15  (meters)          (06/22/05) GPS OBS
AT0804  GEOID HEIGHT-         -25.68  (meters)                     GEOID03
AT0804  OBS GRAVITY -     979,309.8   (mgal)                        GRAV_OBS
AT0804
AT0804  HORZ ORDER  -  B
AT0804  ELLP ORDER  -  FOURTH    CLASS I
AT0804
AT0804.The horizontal coordinates were established by GPS observations
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AT0804.and adjusted by the National Geodetic Survey in June 2005..
AT0804.The horizontal coordinates are valid at the epoch date displayed above.
AT0804.The epoch date for horizontal control is a decimal equivalence
AT0804.of Year/Month/Day.
AT0804
AT0804 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AT0804 ** and geoid heights are valid at the date of observation. These heights
AT0804 ** must always be validated when used as control.
AT0804 ** The orthometric height was determined by GPS observations using
AT0804 ** precise GPS observation and processing techniques and a new
AT0804 ** realization of GEOID03. It supersedes the leveled height previously
AT0804 ** determined for this station.
AT0804 ** The geoid height was determined by a new realization of GEOID03 for the
AT0804 ** epoch indicated which incorporates improved geoid heights for the
AT0804 ** Southern Louisiana Subsidence area.
AT0804 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AT0804.The orthometric height was determined by GPS observations and a
AT0804.high-resolution geoid model using precise GPS observation and
AT0804.processing techniques. It supersedes the leveled height previously
AT0804.determined for this station.
AT0804
AT0804.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AT0804
AT0804.The Laplace correction was computed from DEFLEC99 derived deflections.
AT0804
AT0804.The ellipsoidal height was determined by GPS observations
AT0804.and is referenced to NAD 83.
AT0804
AT0804.The geoid height was determined by GEOID03.
AT0804.The observed gravity was obtained from relative gravimeter ties
AT0804.to the IGSN71 gravity network.
AT0804
AT0804;                   North         East     Units Scale Factor Converg.
AT0804;SPC LA S     -   150,091.312 1,152,121.263   MT  0.99992944   +0 47 13.9
AT0804;SPC LA S     -   492,424.58  3,779,917.84   sFT  0.99992944   +0 47 13.9
AT0804;UTM  16      - 3,304,766.395   233,434.144   MT  1.00047681   -1 22 25.8
AT0804
AT0804!             -  Elev Factor  x  Scale Factor =   Combined Factor
AT0804!SPC LA S     -   1.00000379  x   0.99992944  =   0.99993323
AT0804!UTM  16      -   1.00000379  x   1.00047681  =   1.00048060
AT0804
AT0804                          SUPERSEDED SURVEY CONTROL
AT0804
AT0804  NAD 83(1992)-  29 50 40.71916(N)    089 45 32.43101(W) AD(       ) B
AT0804  ELLIP H (12/29/04)  -24.13   (m)                       GP(       ) 4 1
AT0804  ELLIP H (06/20/00)  -24.12   (m)                       GP(       ) 3 1
AT0804  ELLIP H (01/21/93)  -24.10   (m)                       GP(       ) 4 2
AT0804  NAD 83(1992)-  29 50 40.71874(N)    089 45 32.43093(W) AD(       ) A
AT0804  ELLIP H (09/04/92)  -24.10   (m)                       GP(       ) 3 1
AT0804  NAD 83(1986)-  29 50 40.73696(N)    089 45 32.43028(W) AD(       ) 1
AT0804  NAD 27      -  29 50 39.98989(N)    089 45 32.20535(W) AD(       ) 1
AT0804  NAVD 88 (02/14/94)    1.714  (m)           5.62   (f) READJUSTED  3
AT0804  NGVD 29 (02/23/90)    1.82   (m)           6.0    (f) LEVELING    3
AT0804
AT0804.Superseded values are not recommended for survey control.
AT0804.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AT0804.See file dsdata.txt to determine how the superseded data were derived.
AT0804
AT0804_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU3343404766(NAD 83)
AT0804_MARKER: F = FLANGE-ENCASED ROD
AT0804_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)
AT0804_SP_SET: STAINLESS STEEL ROD
AT0804_STAMPING: REGGIO 2 1987
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AT0804_MARK LOGO: NGS
AT0804_PROJECTION: FLUSH
AT0804_MAGNETIC: I = MARKER IS A STEEL ROD
AT0804_STABILITY: A = MOST RELIABLE AND EXPECTED TO HOLD
AT0804+STABILITY: POSITION/ELEVATION WELL
AT0804_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AT0804+SATELLITE: SATELLITE OBSERVATIONS - January 24, 2006
AT0804_ROD/PIPE-DEPTH: 20.7 meters
AT0804_SLEEVE-DEPTH  : 1 meters
AT0804
AT0804  HISTORY     - Date     Condition        Report By
AT0804  HISTORY     - 1987     MONUMENTED       LADTD
AT0804  HISTORY     - 1988     GOOD             BUN-Y
AT0804  HISTORY     - 19880920 GOOD             LADTD
AT0804  HISTORY     - 19890119 GOOD
AT0804  HISTORY     - 19910903 GOOD             LADTD
AT0804  HISTORY     - 19920316 GOOD
AT0804  HISTORY     - 19920330 GOOD
AT0804  HISTORY     - 19940620 GOOD             LADTD
AT0804  HISTORY     - 19960215 GOOD             NGS
AT0804  HISTORY     - 19980217 GOOD             NGS
AT0804  HISTORY     - 19980311 GOOD             NGS
AT0804  HISTORY     - 20030402 GOOD             3001
AT0804  HISTORY     - 20030820 GOOD             INDIV
AT0804  HISTORY     - 20040419 GOOD             NGS
AT0804  HISTORY     - 20060124 GOOD             3001
AT0804
AT0804                          STATION DESCRIPTION
AT0804
AT0804'DESCRIBED BY LA TRANSP AND DEV 1987 (TLH)
AT0804'THE STATION IS LOCATED IN THE NORTHEAST END OF REGGIO ON STATE
AT0804'HIGHWAY 46.
AT0804'OWNERSHIP--LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT.
AT0804'
AT0804'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAYS 300 AND 46
AT0804'IN REGGIO GO NORTHWEST FOR 0.46 KM (0.3 MI) ON HIGHWAY 46 TO THE
AT0804'FAR END OF THE BRIDGE AND THE STATION ON THE RIGHT.
AT0804'
AT0804'THE STATION IS A STANDARD VERTICAL DATUM POINT ATTACHED TO A
AT0804'STAINLESS STEEL ROD ACCESSED THROUGH A LOGO CAP
AT0804'STAMPED---REGGIO 2 1987---,
AT0804'7.6 METERS (24.9 FT) NORTHEAST FROM THE CENTER OF THE NORTH BOUND
AT0804'LANES OF THE HIGHWAY,
AT0804'1.1 METERS (5.6 FT) NORTH FROM THE NORTH END OF THE BANNISTER,
AT0804'0.7 METERS (2.3 FT) NORTHEAST FROM A BRIDGE CURB,
AT0804'0.5 METERS (1.6 FT) WEST FROM THE NORTH CORNER OF THE ABUTMENT WING
AT0804'AND
AT0804'1.2 METERS (4 FT) NORTH FROM A FIBERGLASS WITNESS POST.
AT0804
AT0804                          STATION RECOVERY (1988)
AT0804
AT0804'RECOVERY NOTE BY BURK AND N-Y 1988
AT0804'0.5 KM (0.30 MI) NW FROM REGGIO.
AT0804'LOCATED 0.48 KM (0.30 MI) NORTHWEST ALONG STATE HIGHWAY 46 FROM THE
AT0804'CROSSROADS AT REGGIO, TO THE WEST END OF THE BRIDGE AND THE MARK ON
AT0804'THE RIGHT.  IT IS 7.62 M (25.0 FT) NORTH OF THE CENTERLINE OF THE
AT0804'EAST-BOUND LANE, 1.07 M (3.5 FT) NORTHWEST OF THE NORTHWEST END OF
AT0804'THE BANNISTER, 0.67 M (2.2 FT) NORTHEAST OF THE BRIDGE CURB AND 0.46
AT0804'M (1.5 FT) FROM THE NORTH CORNER OF THE ABUTMENT WING.  NOTE--ACCESS
AT0804'TO DATUM POINT IS HAD THROUGH A 5-INCH NGS LOGO CAP,
AT0804'(THIS IS A 3-D GPS STATION MARK).
AT0804
AT0804                          STATION RECOVERY (1988)
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AT0804
AT0804'RECOVERY NOTE BY LA TRANSP AND DEV 1988
AT0804'THE STATION IS LOCATED IN THE NORTHWEST EDGE OF REGGIO ON STATE
AT0804'HIGHWAY 46.  OWNERSHIP--LOUISIANA DEPARTMENT OF TRANSPORTATION AND
AT0804'DEVELOPMENT.
AT0804'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAYS 300 AND 46 IN
AT0804'REGGIO GO NORTHWEST FOR 0.46 KM (0.30 MI) ON HIGHWAY 46 TO THE FAR END
AT0804'OF THE BRIDGE AND THE STATION ON THE RIGHT.
AT0804'THE STATION IS A STAINLESS STEEL ROD ACCESSED THROUGH A LOGO CAP, 7.6
AT0804'M (24.9 FT) NORTHEAST FROM THE CENTER OF THE NORTH BOUND LANES OF THE
AT0804'HIGHWAY, 1.1 M (3.6 FT) NORTH FROM THE NORTH END OF THE BANISTER, 0.7
AT0804'M (2.3 FT) NORTHEAST FROM A BRIDGE CURB, 0.5 M (1.6 FT) WEST FROM THE
AT0804'NORTH CORNER OF THE ABUTMENT WING AND 1.2 M (3.9 FT) NORTH FROM A
AT0804'FIBERGLASS WITNESS POST.
AT0804
AT0804                          STATION RECOVERY (1989)
AT0804
AT0804'RECOVERED 1989
AT0804'RECOVERED IN GOOD CONDITION.
AT0804
AT0804                          STATION RECOVERY (1991)
AT0804
AT0804'RECOVERY NOTE BY LA TRANSP AND DEV 1991
AT0804'THE STATION IS LOCATED IN THE NORTHEAST END OF REGGIO ON STATE HIGHWAY
AT0804'46.  OWNERSHIP--LOUISIANA DEPARTMENT OF TRANSPORTATION AND
AT0804'DEVELOPMENT.
AT0804'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAYS 46 AND 300 IN
AT0804'REGGIO, GO NORTHWEST FOR 0.3 MI (0.5 KM) ON HIGHWAY 46 TO THE NORTH
AT0804'END OF A BRIDGE AND THE STATION SET ON THE RIGHT.
AT0804'THE STATION IS 25.0 FT (7.6 M) NORTHEAST FROM THE CENTER OF THE NORTH
AT0804'BOUND LANES OF THE HIGHWAY, 5.5 FT (1.7 M) NORTH FROM THE NORTH END
AT0804'OF THE BANNISTER, 2.0 FT (0.6 M) NORTHEAST FROM A BRIDGE CURB, 1.5 FT
AT0804'(0.5 M) WEST FROM THE NORTH CORNER OF THE NORTH BOUND BRIDGE
AT0804'ABUTMENT, 1.5 FT (0.5 M) NORTHWEST FROM A FIBERGLASS WITNESS POST,
AT0804'FLUSH WITH THE GROUND AND ABOUT LEVEL WITH THE HIGHWAY.
AT0804
AT0804                          STATION RECOVERY (1992)
AT0804
AT0804'RECOVERED 1992
AT0804'RECOVERED IN GOOD CONDITION.
AT0804
AT0804                          STATION RECOVERY (1992)
AT0804
AT0804'RECOVERED 1992
AT0804'RECOVERED IN GOOD CONDITION.
AT0804
AT0804                          STATION RECOVERY (1994)
AT0804
AT0804'RECOVERY NOTE BY LA TRANSP AND DEV 1994 (SLC)
AT0804'RECOVERED AS DESCRIBED.
AT0804
AT0804                          STATION RECOVERY (1996)
AT0804
AT0804'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (ALG)
AT0804'RECOVERED AS DESCRIBED.
AT0804
AT0804                          STATION RECOVERY (1998)
AT0804
AT0804'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (CSM)
AT0804'RECOVERED AS DESCRIBED.  NOTE--THE PREVIOUS DESCRIPTION INCORRECTLY
AT0804'STATES THE ROD HAS NO SLEEVE.
AT0804
AT0804                          STATION RECOVERY (1998)
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 AT0804
 AT0804'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (CSM)
 AT0804'RECOVERED AS DESCRIBED.  NOTE--THE PREVIOUS DESCRIPTION INCORRECTLY
 AT0804'STATES THE ROD HAS NO SLEEVE.
 AT0804
 AT0804                          STATION RECOVERY (2003)
 AT0804
 AT0804'RECOVERY NOTE BY 3001, INC 2003 (MH)
 AT0804'THE STATION IS LOCATED NORTHWEST OF REGGIO ON LA HWY 46, 14.09 MILES
 AT0804'SOUTHEAST OF  INTERSECTION OF LA HWY 47 AND HWY 39 IN CHALMETTE, LA.
 AT0804'6.95 MILES EAST SOUTHEAST OF  INTERSECTION OF HWY 39 AND HWY 46 IN ST.
 AT0804'BERNARD, 4.83 MILES WEST OF THE END OF HWY 46 IN  SHELL BEACH.
 AT0804'
 AT0804'OWNERSHIP- LA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
 AT0804'
 AT0804'TO REACH THE STATION FROM THE INTERSECTION OF LA HWY 300 AND HWY 46 IN
 AT0804'REGGIO HEAD  NORTHWEST FOR 0.3 MILES ON HWY 46, TO THE NORTHEAST
 AT0804'CORNER OF A BRIDGE AND THE MARK IS   ON THE RIGHT.
 AT0804'
 AT0804'THE STATION IS 25.0 FT. NORTHEAST OF CENTERLINE OF NORTH BOUND LANES
 AT0804'OF HWY, 3.6 FT.  NORTH FROM NORTH END OF BRIDGE CONCRETE RAIL, 2.1 FT.
 AT0804'NORTHEAST OF A CONCRETE CURB, 1.5  FT. NORTHWEST OF A CONCRETE
 AT0804'ABUTMENT WING. STATION IS A STAINLESS STEEL ROD ACCESSED  THROUGH A
 AT0804'LOGO CAP STAMPED- REGGIO2 1987, FLUSH WITH TOP OF LOGO SLEEVE COVER
 AT0804'MISSING  OTHERWISE IN GOOD CONDITION.
 AT0804
 AT0804                          STATION RECOVERY (2003)
 AT0804
 AT0804'RECOVERY NOTE BY INDIVIDUAL CONTRIBUTORS 2003 (JCJ)
 AT0804'RECOVERED IN GOOD CONDITION.
 AT0804
 AT0804                          STATION RECOVERY (2004)
 AT0804
 AT0804'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
 AT0804'RECOVERED AS DESCRIBED
 AT0804
 AT0804                          STATION RECOVERY (2006)
 AT0804
 AT0804'RECOVERY NOTE BY 3001, INC 2006 (JCP)
 AT0804'THE STATION IS LOCATED ST. BERNARD PARISH NEAR THE COMMUNITY OF
 AT0804'REGGIO, 13.95 MILES SE OF CHALMETTE. OWNERSHIP - LOUISIANA DEPARTMENT
 AT0804'OF HWYS.
 AT0804'
 AT0804'TO REACH THE STATION FROM THE INTERSECTION OF HIGHWAYS 47 AND 39 IN
 AT0804'CHALMETTE, GO SE ON HIGHWAY 39 FOR 8.25 MILES TO HIGHWAY 46 ON THE
 AT0804'LEFT.  TURN LEFT ON HIGHWAY 46 AND GO 7.6 MILES TO THE MARK ON THE
 AT0804'LEFT.  THE STATION IS 25.0 FEET NE OF OF THE HIGHWAY 46 NORTHBOUND
 AT0804'LANES, 3.6 FEET NORTH OF THE NORTH END OF THE NW CORNER OF A BRIDGE
 AT0804'CONCRETE RAIL, 2.1 FEET NE OF A CONCRETE CURB, 1.5 FEET NW OF A
 AT0804'CONCRETE ABUTMENT WINGWALL. THE MARK IS A STAINLESS STEEL ROD WITH
 AT0804'ACCESS THROUGH A LOGO CAP STAMPED REGGIO 2 1987.  NOTE THE COVER IS
 AT0804'MISSING.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AF9574 *********************************************************************
 AF9574  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AF9574  CORS         -  This is a GPS Continuously Operating Reference Station.
 AF9574  DESIGNATION -  STENNIS CORS ARP
 AF9574  CORS_ID      -  NDBC
 AF9574  PID          -  AF9574
 AF9574  STATE/COUNTY-  MS/HANCOCK
 AF9574  USGS QUAD    -  LOGTOWN (1993)
 AF9574
 AF9574                         *CURRENT SURVEY CONTROL
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AF9574  ___________________________________________________________________
AF9574* NAD 83(CORS)-  30 21 22.59138(N)    089 36 36.97621(W)     ADJUSTED
AF9574* NAVD 88     -        16.88 **(meters)      55.4  **(feet)  GPS OBS(2004.65)
AF9574  **This station is located in a subsidence area (see below).
AF9574  ___________________________________________________________________
AF9574  EPOCH DATE  -        2002.00
AF9574  X           -      37,468.090 (meters)                     COMP
AF9574  Y           -  -5,508,266.605 (meters)                     COMP
AF9574  Z           -   3,204,510.665 (meters)                     COMP
AF9574  ELLIP HEIGHT-         -10.26  (meters)          (03/??/02) GPS OBS
AF9574  GEOID HEIGHT-         -27.17  (meters)                     GEOID03
AF9574
AF9574  HORZ ORDER  -  SPECIAL (CORS)
AF9574  ELLP ORDER  -  SPECIAL (CORS)
AF9574
AF9574.ITRF positions are available for this station.
AF9574.The coordinates were established by GPS observations
AF9574.and adjusted by the National Geodetic Survey in March 2002..
AF9574.The coordinates are valid at the epoch date displayed above.
AF9574.The epoch date for horizontal control is a decimal equivalence
AF9574.of Year/Month/Day.
AF9574
AF9574 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
AF9574 ** and geoid heights are valid at the date of observation. These heights
AF9574 ** must always be validated when used as control.
AF9574 ** The orthometric height was determined by GPS observations using
AF9574 ** precise GPS observation and processing techniques and a new
AF9574 ** realization of GEOID03. It supersedes the leveled height previously
AF9574 ** determined for this station.
AF9574 ** The geoid height was determined by a new realization of GEOID03 for the
AF9574 ** epoch indicated which incorporates improved geoid heights for the
AF9574 ** Southern Louisiana Subsidence area.
AF9574 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
AF9574.The orthometric height was determined by GPS observations and a
AF9574.high-resolution geoid model using precise GPS observation and
AF9574.processing techniques.
AF9574
AF9574.The PID for the CORS L1 Phase Center is AB8531.
AF9574
AF9574.The XYZ, and position/ellipsoidal ht. are equivalent.
AF9574
AF9574.The ellipsoidal height was determined by GPS observations
AF9574.and is referenced to NAD 83.
AF9574
AF9574.The geoid height was determined by GEOID03.
AF9574
AF9574;                    North         East     Units Scale Factor Converg.
AF9574;SPC MS E     -    95,170.385   225,307.984   MT  1.00001880   -0 23 33.6
AF9574;SPC MS E     -   312,238.17    739,197.94   sFT  1.00001880   -0 23 33.6
AF9574
AF9574!             -  Elev Factor  x  Scale Factor =   Combined Factor
AF9574!SPC MS E     -   1.00000161  x   1.00001880  =   1.00002041
AF9574
AF9574                          SUPERSEDED SURVEY CONTROL
AF9574
AF9574  NAD 83(CORS)-  30 21 22.59167(N)    089 36 36.97624(W) AD(1997.00) c
AF9574  ELLIP H (07/??/98)  -10.27   (m)                       GP(1997.00) c c
AF9574  NAD 83(CORS)-  30 21 22.59171(N)    089 36 36.97633(W) AD(1996.00) c
AF9574  ELLIP H (12/??/96)  -10.21   (m)                       GP(1996.00) c c
AF9574
AF9574.Superseded values are not recommended for survey control.
AF9574.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
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 AF9574.See file dsdata.txt to determine how the superseded data were derived.
 AF9574
 AF9574_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU4910761154(NAD 83)
 AF9574_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 AF9574
 AF9574                          STATION DESCRIPTION
 AF9574
 AF9574'DESCRIBED BY NATIONAL GEODETIC SURVEY 2002
 AF9574'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
 AF9574'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
 AF9574'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
 AF9574'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
 AF9574'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
 AT0760 ***********************************************************************
 AT0760  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
 AT0760  DESIGNATION -  V 375
 AT0760  PID         -  AT0760
 AT0760  STATE/COUNTY-  LA/ORLEANS
 AT0760  USGS QUAD   -  CHALMETTE (1994)
 AT0760
 AT0760                         *CURRENT SURVEY CONTROL
 AT0760  ___________________________________________________________________
 AT0760* NAD 83(1992)-  29 55 01.55070(N)    089 58 18.04218(W)     ADJUSTED
 AT0760* NAVD 88     -         0.71 **(meters)       2.3  **(feet)  GPS OBS(2004.65)
 AT0760  **This station is located in a subsidence area (see below).
 AT0760  ___________________________________________________________________
 AT0760  EPOCH DATE  -        2004.65
 AT0760  X           -       2,734.905 (meters)                     COMP
 AT0760  Y           -  -5,532,823.275 (meters)                     COMP
 AT0760  Z           -   3,162,399.142 (meters)                     COMP
 AT0760  LAPLACE CORR-           0.15  (seconds)                    DEFLEC99
 AT0760  ELLIP HEIGHT-         -25.24  (meters)         (06/22/05) GPS OBS
 AT0760  GEOID HEIGHT-         -25.95  (meters)                     GEOID03
 AT0760  DYNAMIC HT  -           0.71  (meters)       2.3   (feet)  COMP
 AT0760  MODELED GRAV-     979,311.5   (mgal)                       NAVD 88
 AT0760
 AT0760  HORZ ORDER  -  B
 AT0760  VERT ORDER  -  FIRST     CLASS II (See Below)
 AT0760  ELLP ORDER  -  FOURTH    CLASS I

 AT0760
 AT0760.The horizontal coordinates were established by GPS observations
 AT0760.and adjusted by the National Geodetic Survey in June 2005..
 AT0760.The horizontal coordinates are valid at the epoch date displayed above.
 AT0760.The epoch date for horizontal control is a decimal equivalence
 AT0760.of Year/Month/Day.
 AT0760
 AT0760 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
 AT0760 ** and geoid heights are valid at the date of observation. These heights
 AT0760 ** must always be validated when used as control.
 AT0760 ** The orthometric height was determined by GPS observations using
 AT0760 ** precise GPS observation and processing techniques and a new
 AT0760 ** realization of GEOID03. It supersedes the leveled height previously
 AT0760 ** determined for this station.
 AT0760 ** The geoid height was determined by a new realization of GEOID03 for the
 AT0760 ** epoch indicated which incorporates improved geoid heights for the
 AT0760 ** Southern Louisiana Subsidence area.
 AT0760 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
 AT0760.The orthometric height was determined by GPS observations and a
 AT0760.high-resolution geoid model using precise GPS observation and
 AT0760.processing techniques. It supersedes the leveled height previously
 AT0760.determined for this station.
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AT0760.WARNING-GPS observations at this control monument resulted in a GPS
AT0760.derived orthometric height which differed from the leveled height by
AT0760.more than one decimeter (0.1 meter).
AT0760.The vertical order pertains to the first NAVD 88 superseded value.
AT0760
AT0760.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AT0760
AT0760.The Laplace correction was computed from DEFLEC99 derived deflections.
AT0760
AT0760.The ellipsoidal height was determined by GPS observations
AT0760.and is referenced to NAD 83.
AT0760
AT0760.The geoid height was determined by GEOID03.
AT0760
AT0760.The dynamic height is computed by dividing the NAVD 88
AT0760.geopotential number by the normal gravity value computed on the
AT0760.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AT0760.degrees latitude (g = 980.6199 gals.).
AT0760
AT0760.The modeled gravity was interpolated from observed gravity values.
AT0760
AT0760;                    North         East     Units Scale Factor Converg.
AT0760;SPC LA S     -   157,858.377 1,131,477.366   MT  0.99992681   +0 40 51.0
AT0760;SPC LA S     -   517,907.03  3,712,188.66   sFT  0.99992681   +0 40 51.0
AT0760;UTM  16      - 3,313,312.157   213,085.466   MT  1.00061579   -1 28 59.3
AT0760;UTM  15      - 3,313,455.172   792,385.972   MT  1.00065491   +1 30 41.2
AT0760
AT0760!             -  Elev Factor  x  Scale Factor =   Combined Factor
AT0760!SPC LA S     -   1.00000396  x   0.99992681  =   0.99993077
AT0760!UTM  16      -   1.00000396  x   1.00061579  =   1.00061976
AT0760!UTM  15      -   1.00000396  x   1.00065491  =   1.00065888
AT0760
AT0760                          SUPERSEDED SURVEY CONTROL
AT0760
AT0760  NAD 83(1992)-  29 55 01.55098(N)    089 58 18.04288(W) AD(       ) B
AT0760  ELLIP H (05/09/05)  -25.20   (m)                       GP(       ) 4 2
AT0760  NAD 83(1992)-  29 55 01.55047(N)    089 58 18.04138(W) AD(       ) 1
AT0760  ELLIP H (01/21/93)  -25.18   (m)                       GP(       ) 4 2
AT0760  NAD 83(1986)-  29 55 01.56676(N)    089 58 18.04032(W) AD(       ) 1
AT0760  NAVD 88 (12/05/96)    0.890  (m)            2.92   (f) ADJUSTED    1 2
AT0760  NAVD 88 (02/14/94)    0.873  (m)            2.86   (f) UNKNOWN     1 2
AT0760  NGVD 29 (05/21/91)    0.933  (m)            3.06   (f) ADJUSTED    1 2
AT0760
AT0760.Superseded values are not recommended for survey control.
AT0760.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AT0760.See file dsdata.txt to determine how the superseded data were derived.
AT0760
AT0760_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU1308513312(NAD 83)
AT0760_MARKER: I = METAL ROD
AT0760_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)
AT0760_SP_SET: STAINLESS STEEL ROD IN SLEEVE
AT0760_STAMPING: V 375 1985
AT0760_MARK LOGO: NGS
AT0760_PROJECTION: PROJECTING 6 CENTIMETERS
AT0760_MAGNETIC: N = NO MAGNETIC MATERIAL
AT0760_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AT0760_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AT0760+SATELLITE: SATELLITE OBSERVATIONS - January 08, 2006
AT0760_ROD/PIPE-DEPTH: 25.6 meters
AT0760_SLEEVE-DEPTH  : 18.2 meters
AT0760
AT0760  HISTORY     - Date     Condition        Report By
AT0760  HISTORY     - 1985     MONUMENTED       NGS
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AT0760  HISTORY     - 19880920 GOOD             LADTD
AT0760  HISTORY     - 19890124 GOOD
AT0760  HISTORY     - 19901025 GOOD             NGS
AT0760  HISTORY     - 19941202 GOOD             NGS
AT0760  HISTORY     - 19960205 GOOD             NGS
AT0760  HISTORY     - 20021119 GOOD             3001
AT0760  HISTORY     - 20040414 GOOD             JCLS
AT0760  HISTORY     - 20040414 GOOD             JCLS
AT0760  HISTORY     - 20040418 GOOD             NGS
AT0760  HISTORY     - 20050910 GOOD             JCLS
AT0760  HISTORY     - 20051008 GOOD             NGS
AT0760  HISTORY     - 20060108 GOOD             3001
AT0760
AT0760                          STATION DESCRIPTION
AT0760
AT0760'DESCRIBED BY NATIONAL GEODETIC SURVEY 1985
AT0760'IN NEW ORLEANS.
AT0760'THE MARK IS ABOVE LEVEL WITH ROAD.
AT0760'IN NEW ORLEANS, ON THE WEST BANK, AT THE SOUTHEAST SIDE OF THE
AT0760'ENTRANCE GATE OF THE ALGIERS LOCKS, LOCATED AT THE SOUTH END OF BLYTHE
AT0760'STREET, 6.85 METERS (22.5 FT) SOUTHEAST OF THE CENTER OF THE ENTRANCE
AT0760'ROAD LEADING TO THE LOCKS, 5.85 METERS (19.2 FT) SOUTH OF THE
AT0760'SOUTHEAST ENTRANCE GATE POST, 3.53 METERS (11.6 FT) WEST OF A CONCRETE
AT0760'LAMP POST.  NOTE--ACCESS TO DATUM POINT IS HAD THROUGH A 5-INCH LOGO
AT0760'CAP.
AT0760'THE MARK IS 3.23 METERS  W FROM  A WITNESS POST
AT0760
AT0760                          STATION RECOVERY (1988)
AT0760
AT0760'RECOVERY NOTE BY LA TRANSP AND DEV 1988
AT0760'IN NEW ORLEANS, ON THE WEST BANK , AT THE SOUTHEAST SIDE OF THE
AT0760'ENTRANCE GATE OF THE ALGIERS LOCKS, LOCATED AT THE SOUTH END OF BLYTHE
AT0760'STREET, 6.85 M (22.5 FT) SOUTHEAST OF THE CENTER OF THE ENTRANCE ROAD
AT0760'LEADING TO THE LOCKS, 5.85 M (19.2 FT) SOUTH OF THE SOUTHEAST ENTRANCE
AT0760'GATE POST, 3.53 M (11.6 FT) WEST OF A CONCRETE LAMP POST ABOUT LEVEL
AT0760'WITH THE ROAD AND 3.23 M (10.6 FT) WEST FROM A WITNESS POST.
AT0760'NOTE--ACCESS TO DATUM POINT IS HAD THROUGH A 5-INCH LOGO CAP.
AT0760
AT0760                          STATION RECOVERY (1989)
AT0760
AT0760'RECOVERED 1989
AT0760'RECOVERED IN GOOD CONDITION.
AT0760
AT0760                          STATION RECOVERY (1990)
AT0760
AT0760'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
AT0760'0.5 KM (0.3 MI) SOUTHWESTERLY ALONG BLYTHE STREET FROM ITS JUNCTION
AT0760'WITH PATTERSON ROAD IN ALGIERS, ON THE U.S. ARMY CORPS OF ENGINEERS
AT0760'ALGIERS LOCK PROPERTY, 6.6 M (21.7 FT) NORTHEAST OF AND LEVEL WITH
AT0760'THE CENTER OF THE ALGIERS LOCK ENTRANCE ROAD AND GATE, AND 3.6 M
AT0760'(11.8 FT) SOUTHEAST OF A UTILITY LIGHT POST.  NOTE--ACCESS TO DATUM
AT0760'POINT IS HAD THROUGH A 5-INCH LOGO CAP.
AT0760
AT0760                          STATION RECOVERY (1994)
AT0760
AT0760'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (GAS)
AT0760'IN ALGIERS, AT 3500 BLYTHE STREET, 109.5 M (359.3 FT) NORTHWEST OF THE
AT0760'NORTHWEST CORNER OF THE U.S. ARMY CORP OF ENGINEERS GENERATOR BUILDING
AT0760'AT 3500 BLYTHE STREET, 6.9 M (22.6 FT) EAST OF AND LEVEL WITH THE
AT0760'STREET CENTER, 5.6 M (18.4 FT) SOUTHEAST OF THE EAST POST OF A GATE,
AT0760'3.3 M (10.8 FT) SOUTH OF A UTILITY POLE, AND 3.1 M (10.2 FT) SOUTH OF
AT0760'A WITNESS POST.  NOTE--ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH
AT0760'LOGO CAP.  THE MARK IS ON THE PROPERTY OF THE U.S. ARMY CORP OF
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AT0760'ENGINEERS ALGIERS LOCK, 3500 BLYTHE STREET, ALGIERS, LA 70131.
AT0760
AT0760                          STATION RECOVERY (1996)
AT0760
AT0760'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (ALG)
AT0760'RECOVERED AS DESCRIBED.
AT0760
AT0760                          STATION RECOVERY (2002)
AT0760
AT0760'RECOVERY NOTE BY 3001, INC 2002 (KC)
AT0760'THE STATION IS LOCATED IN NEW ORLEANS, ON WEST BANK, 4.5 MILES NORTH
AT0760'OF BELLE CHASE  FERRY, 5.5 MILES SOUTHEAST OF GREATER NEW ORLEANS
AT0760'BRIDGE, OVER MISSISSIPPI RIVER, 0.5  MILES SOUTH OF CHALMETTE FERRY.
AT0760'
AT0760'OWNERSHIP- CORPS OF ENGINEERS
AT0760'
AT0760'TO REACH THE STATION FROM THE INTERSECTION OF GENERAL DE GAULLE AVENUE
AT0760'AND SULLEN  ROAD, NEAR THE BRIDGE OVER INTERCOASTAL WATERWAY, GO NORTH
AT0760'ON SULLEN ROAD TO  PATTERSON DRIVE (LEVEE ROAD), TURN RIGHT ON
AT0760'PATTERSON DRIVE AND PROCEED EAST ON  PATTERSON FOR 0.9 MILES TO BLYTHE
AT0760'ROAD , TURN RIGHT ON BLYTHE AND GO TO GATE ENTRANCE  TO LOCKS, PASSING
AT0760'THROUGH GATE AND MARK ON LEFT NEAR GATE.
AT0760'
AT0760'THE STATION IS 22.6 FEET EAST OF CENTERLINE OF ENTRANCE ROAD TO LOCKS,
AT0760'18.3 FEET  SOUTHEAST OF THE EAST GATE POST FOR GATE, 107 FEET SOUTH OF
AT0760'A LIGHT POLE, 10 FEET SOUTH  OF A WITNESS SIGN.  STATION IS A
AT0760'STAINLESS ROD DRIVEN 25.6 METERS AND STAMPED V 375.
AT0760
AT0760                          STATION RECOVERY (2004)
AT0760
AT0760'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2004 (FJO)
AT0760'RECOVERED IN GOOD CONDITION.
AT0760
AT0760                          STATION RECOVERY (2004)
AT0760
AT0760'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2004
AT0760'RECOVERED IN GOOD CONDITION.
AT0760
AT0760                          STATION RECOVERY (2004)
AT0760
AT0760'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (KLF)
AT0760'RECOVERED AS DESCRIBED
AT0760
AT0760                          STATION RECOVERY (2005)
AT0760
AT0760'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2005 (MRY)
AT0760'RECOVERED IN GOOD CONDITION.
AT0760
AT0760                          STATION RECOVERY (2005)
AT0760
AT0760'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2005 (KLF)
AT0760'RECOVERED AS DESCRIBED.
AT0760
AT0760                          STATION RECOVERY (2006)
AT0760
AT0760'RECOVERY NOTE BY 3001, INC 2006
AT0760'RECOVERED AS DESCRIBED.
1        National Geodetic Survey,   Retrieval Date = APRIL 13, 2006
BH3007 ***********************************************************************
BH3007  HT_MOD       -  This is a Louisiana Height Modernization Survey Station.
BH3007  TIDAL BM     -  This is a Tidal Bench Mark.
BH3007  DESIGNATION -  WES 19
BH3007  PID          -  BH3007
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BH3007  STATE/COUNTY-  LA/ORLEANS
BH3007  USGS QUAD   -  LITTLE WOODS (1994)
BH3007
BH3007                         *CURRENT SURVEY CONTROL
BH3007  ___________________________________________________________________
BH3007* NAD 83(1992)-  30 00 25.42356(N)    089 56 19.81680(W)     ADJUSTED
BH3007* NAVD 88     -        -0.11 **(meters)      -0.4  **(feet)  GPS OBS(2004.65)
BH3007  **This station is located in a subsidence area (see below).
BH3007  ___________________________________________________________________
BH3007  EPOCH DATE  -        2004.65
BH3007  X           -       5,900.851 (meters)                     COMP
BH3007  Y           -  -5,527,839.247 (meters)                     COMP
BH3007  Z           -   3,171,038.528 (meters)                     COMP
BH3007  LAPLACE CORR-           0.00  (seconds)                    DEFLEC99
BH3007  ELLIP HEIGHT-         -26.30  (meters)         (04/11/06) GPS OBS
BH3007  GEOID HEIGHT-         -26.19  (meters)                     GEOID03
BH3007  DYNAMIC HT  -          -0.11  (meters)      -0.4   (feet)  COMP
BH3007  MODELED GRAV-     979,315.8   (mgal)                       NAVD 88
BH3007
BH3007  HORZ ORDER  -  FIRST
BH3007  VERT ORDER  -  FIRST     CLASS II (See Below)
BH3007  ELLP ORDER  -  FOURTH    CLASS II
BH3007
BH3007.The horizontal coordinates were established by GPS observations
BH3007.and adjusted by the National Geodetic Survey in April 2006..
BH3007.The horizontal coordinates are valid at the epoch date displayed above.
BH3007.The epoch date for horizontal control is a decimal equivalence
BH3007.of Year/Month/Day.
BH3007
BH3007 ** Due to the variability of land subsidence, the orthometric, ellipsoid,
BH3007 ** and geoid heights are valid at the date of observation. These heights
BH3007 ** must always be validated when used as control.
BH3007 ** The orthometric height was determined by GPS observations using
BH3007 ** precise GPS observation and processing techniques and a new
BH3007 ** realization of GEOID03. It supersedes the leveled height previously
BH3007 ** determined for this station.
BH3007 ** The geoid height was determined by a new realization of GEOID03 for the
BH3007 ** epoch indicated which incorporates improved geoid heights for the
BH3007 ** Southern Louisiana Subsidence area.
BH3007 ** (see www.ngs.noaa.gov/PC_PROD/GEOID03/).
BH3007.The orthometric height was determined by GPS observations and a
BH3007.high-resolution geoid model using precise GPS observation and
BH3007.processing techniques. It supersedes the leveled height previously
BH3007.determined for this station.
BH3007.WARNING-GPS observations at this control monument resulted in a GPS
BH3007.derived orthometric height which differed from the leveled height by
BH3007.more than one decimeter (0.1 meter).
BH3007.The vertical order pertains to the first NAVD 88 superseded value.
BH3007
BH3007.This Tidal Bench Mark is designated as VM 6520
BH3007.by the Center for Operational Oceanographic Products and Services.
BH3007
BH3007.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BH3007
BH3007.The Laplace correction was computed from DEFLEC99 derived deflections.
BH3007
BH3007.The ellipsoidal height was determined by GPS observations
BH3007.and is referenced to NAD 83.
BH3007
BH3007.The geoid height was determined by GEOID03.
BH3007
BH3007.The dynamic height is computed by dividing the NAVD 88
BH3007.geopotential number by the normal gravity value computed on the
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BH3007.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BH3007.degrees latitude (g = 980.6199 gals.).
BH3007
BH3007.The modeled gravity was interpolated from observed gravity values.
BH3007
BH3007;                    North         East     Units Scale Factor Converg.
BH3007;SPC LA S     -   167,867.783 1,134,526.830   MT  0.99992575   +0 41 50.2
BH3007;SPC LA S     -   550,746.22  3,722,193.44   sFT  0.99992575   +0 41 50.2
BH3007;UTM  16      - 3,323,205.859   216,513.373   MT  1.00059164   -1 28 14.6
BH3007;UTM  15      - 3,323,515.270   795,291.801   MT  1.00067596   +1 31 55.3
BH3007
BH3007!             -  Elev Factor  x  Scale Factor =   Combined Factor
BH3007!SPC LA S     -   1.00000413  x   0.99992575  =   0.99992988
BH3007!UTM  16      -   1.00000413  x   1.00059164  =   1.00059577
BH3007!UTM  15      -   1.00000413  x   1.00067596  =   1.00068009
BH3007
BH3007                          SUPERSEDED SURVEY CONTROL
BH3007
BH3007  ELLIP H (01/21/03)  -26.19   (m)                        GP(        ) 4 2
BH3007  NAD 83(1992)-  30 00 25.42395(N)    089 56 19.81619(W) AD(        ) 1
BH3007  NAD 83(1992)-  30 00 25.42395(N)    089 56 19.81618(W) AD(        ) 1
BH3007  ELLIP H (01/21/93)  -26.17   (m)                        GP(        ) 4 2
BH3007  NAD 83(1986)-  30 00 25.44004(N)    089 56 19.81358(W) AD(        ) 1
BH3007  NAVD 88 (12/05/96)    0.104  (m)            0.34   (f) ADJUSTED    1 2
BH3007  NAVD 88 (02/14/94)    0.129  (m)            0.42   (f) UNKNOWN     1 2
BH3007  NGVD 29 (05/21/91)    0.189  (m)            0.62   (f) ADJUSTED    1 2
BH3007
BH3007.Superseded values are not recommended for survey control.
BH3007.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BH3007.See file dsdata.txt to determine how the superseded data were derived.
BH3007
BH3007_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RBU1651323206(NAD 83)
BH3007_MARKER: DD = SURVEY DISK
BH3007_SETTING: 15 = METAL ROD DRIVEN INTO GROUND. SEE TEXT FOR ADDITIONAL
BH3007+WITH SETTING: INFORMATION.
BH3007_SP_SET: METAL ROD DRIVEN INTO GROUND
BH3007_STAMPING: WES 19 1978
BH3007_MARK LOGO: USE
BH3007_PROJECTION: RECESSED 2 CENTIMETERS
BH3007_MAGNETIC: N = NO MAGNETIC MATERIAL
BH3007_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY
BH3007_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
BH3007+SATELLITE: SATELLITE OBSERVATIONS - March 06, 2006
BH3007
BH3007  HISTORY     - Date     Condition        Report By
BH3007  HISTORY     - 1978     MONUMENTED       USE
BH3007  HISTORY     - 19890120 GOOD
BH3007  HISTORY     - 19901102 GOOD             NGS
BH3007  HISTORY     - 19950119 GOOD             NGS
BH3007  HISTORY     - 20040801 GOOD             EMCINC
BH3007  HISTORY     - 20060306 GOOD             3001
BH3007
BH3007                          STATION DESCRIPTION
BH3007
BH3007'DESCRIBED BY US ENGINEERS 1978
BH3007'THE STATION IS LOCATED IN NEW ORLEANS NEAR THE SOUTHWEST CORNER OF THE
BH3007'NOPSI POWER SUB-STATION PROPERTY AT THE STATE HIGHWAY 47 BRIDGE OVER
BH3007'THE INTRACOASTAL WATERWAY, ABOUT 8 KM (4.95 MI) NORTH OF CHALMETTE AND
BH3007'ABOUT 3.2 KM (2.00 MI) SOUTHWEST OF MICHOUD.
BH3007'TO REACH THE STATION FROM THE JUNCTION OF U S HIGHWAY 90 AND STATE
BH3007'HIGHWAY 47 GO SOUTH FOR 1 KM (0.60 MI) ON HIGHWAY 47 TO THE NORTH END
BH3007'OF THE HIGHWAY 47 BRIDGE OVER THE INTRACOASTAL WATERWAY.  CONTINUE
BH3007'STRAIGHT AHEAD AND GO SOUTH FOR 0.5 KM (0.30 MI) ON THE PAVED ROAD
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BH3007'ALONG THE SIDE OF THE BRIDGE TO THE JUNCTION WITH OLD GENTILLY ROAD.
BH3007'CONTINUE STRAIGHT AHEAD ACROSS OLD GENTILLY ROAD FOR 0.6 KM (0.35 MI)
BH3007'ON THE PAVED ROAD TO AN ELECTRIC SUB-STATION ENTRANCE ON THE LEFT AND
BH3007'THE STATION SET NEAR THE ENTRANCE TO THE SUB-STATION.
BH3007'THE STATION IS A USE DISK CRIMPED ONTO A METAL ROD DRIVEN INTO THE
BH3007'GROUND AND ENCASED IN A 5-INCH PVC PIPE FLUSH WITH THE GROUND 31.1 M
BH3007'(102.0 FT) SOUTH FROM THE CENTER OF THE ENTRANCE GATE INTO THE
BH3007'SUB-STATION, 1.2 WEST FROM A CHAIN LINK FENCE AND 0.6 M (2.0 FT) WEST
BH3007'FROM A METAL WITNESS POST WITH A SIGN ATTACHED.
BH3007
BH3007                          STATION RECOVERY (1989)
BH3007
BH3007'RECOVERED 1989
BH3007'RECOVERED IN GOOD CONDITION.
BH3007
BH3007                          STATION RECOVERY (1990)

BH3007
BH3007'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
BH3007'0.5 KM (0.3 MI) SOUTHERLY ALONG PARIS ROAD FROM THE JUNCTION OF
BH3007'GENTILLY ROAD IN NEW ORLEANS, 80.0 M (262.5 FT) EAST OF THE CENTER OF
BH3007'THE ROAD, 31.1 M (102.0 FT) SOUTH OF THE CENTER OF THE ENTRANCE GATE
BH3007'LEADING TO A SUB-STATION, 1.2 M (3.9 FT) WEST OF A CHAIN-LINK FENCE,
BH3007'AND 0.7 M (2.3 FT) WEST OF A WITNESS POST.  NOTE--THE DISK IS ENCASED
BH3007'IN A 5-INCH PVC PIPE THAT IS FLUSH WITH THE GROUND SURFACE.
BH3007
BH3007                          STATION RECOVERY (1995)
BH3007
BH3007'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1995 (GAS)
BH3007'4.3 KM (2.65 MI) WESTERLY ALONG U.S. HIGHWAY 90 (CHEF MENTEUR HIGHWAY)
BH3007'FROM THE JUNCTION OF INTERSTATE HIGHWAY 610 IN NEW ORLEANS, THENCE 4.5
BH3007'KM (2.80 MI) EASTERLY ALONG GENTILLY ROAD, THENCE 0.6 KM (0.35 MI)
BH3007'SOUTHERLY ALONG PARIS ROAD, 31.2 M (102.4 FT) SOUTH OF THE ROAD CENTER
BH3007'AND A POWER PLANT ENTRANCE GATE, 15.8 M (51.8 FT) EAST OF THE CENTER
BH3007'OF A GRAVEL ROAD, 1.1 M (3.6 FT) WEST OF A CHAIN-LINK FENCE, 0.9 M
BH3007'(3.0 FT) WEST OF A WITNESS POST, 0.4 M (1.3 FT) BELOW THE LEVEL OF THE
BH3007'ROAD, AND 0.3 M (1.0 FT) BELOW THE GROUND SURFACE. NOTE--THE DISK IS
BH3007'ENCASED IN A 5-INCH PVC PIPE AND IS 0.3 M (1.0 FT) BELOW THE GROUND
BH3007'SURFACE.
BH3007
BH3007                          STATION RECOVERY (2004)
BH3007
BH3007'RECOVERY NOTE BY EMC INCORPORATED 2004 (MDG)
BH3007'RECOVERED IN GOOD CONDITION.
BH3007
BH3007                          STATION RECOVERY (2006)
BH3007
BH3007'RECOVERY NOTE BY 3001, INC 2006 (JCP)
BH3007'RECOVERED AS DESCRIBED.

*** retrieval complete.
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# Appendix 36
# Outfall Canal Post-Katrina Topographic Surveys

## 17th Street Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| | | | | | | | **North End** |
| 358 | 15.28 | TCW | Lakefront Levee | 104 | 13.47 | TCW | Hammond Hwy. |
| 357 | 15.42 | TCW | | 105 | 13.47 | TCW | |
| 354 | 14.99 | TCW | | 106 | 13.22 | TCW | |
| 353 | 14.99 | TCW | | 107 | 12.02 | TCW | |
| 352 | 13.30 | TCW | | 108 | 12.34 | TCW | |
| 351 | 12.57 | TCW | | 109 | 12.24 | TCW | |
| 350 | 12.32 | TCW | | 110 | 11.87 | TCW | |
| 349 | 12.55 | TCW | | 114 | 11.90 | TCW | |
| 348 | 12.46 | TCW | | 115 | 12.23 | TCW | |
| 347 | 12.47 | TCW | | 116 | 12.18 | TCW | |
| 346 | 12.41 | TCW | | 117 | 12.08 | TCW | |
| 345 | 12.41 | TCW | | 118 | 12.11 | TCW | |
| 344 | 13.16 | TCW | | 119 | 12.18 | TCW | |
| 343 | 13.14 | TCW | | 120 | 12.07 | TCW | |
| 340 | 13.20 | TCW | | 121 | 12.16 | TCW | |
| 339 | 12.43 | TCW | | 122 | 12.18 | TCW | |
| 338 | 12.40 | TCW | | 123 | 12.11 | TCW | |
| 337 | 12.40 | TCW | | 124 | 12.19 | TCW | |
| 336 | 12.45 | TCW | | 125 | 12.21 | TCW | |
| 325 | 12.55 | TCW | | 126 | 12.16 | TCW | |
| 324 | 12.56 | TCW | | 127 | 12.14 | TCW | |
| 323 | 12.54 | TCW | | 128 | 12.15 | TCW | |
| 322 | 12.54 | TCW | | 129 | 12.12 | TCW | |
| 321 | 12.48 | TCW | | 130 | 12.46 | TCW | |
| 320 | 12.46 | TCW | | 131 | 12.88 | TCW | |
| 319 | 12.51 | TCW | | 132 | 12.91 | TFG | To Veterans Hwy |
| 318 | 12.57 | TCW | | **Mean:** | **12.35** | | |
| 317 | 12.56 | TCW | | **High:** | **13.47** | | |
| 316 | 12.53 | TCW | | **Low:** | **11.87** | | |
| 315 | 12.58 | TCW | | **# of Obs.** | **26** | | |
| 314 | 12.52 | TCW | | | | | |
| 313 | 12.45 | TCW | | 146 | 12.98 | TCW | Veterans Hwy. To |

# 17th Street Canal

| West side of Canal | | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|---|
| Point No. | Elev. | Code | Note | | Point No. | Elev. | Code | Note |
| 312 | 12.48 | TCW | | | 147 | 12.96 | TCW | |
| 311 | 12.53 | TCW | | | 148 | 12.89 | TFG | |
| 310 | 12.59 | TCW | | | 149 | 12.89 | TFG | |
| 309 | 12.58 | TCW | | | 150 | 12.85 | TCW | |
| 308 | 12.57 | TCW | | | 151 | 12.85 | TCW | |
| 307 | 12.65 | TCW | | | 152 | 12.59 | TCW | |
| 306 | 12.63 | TCW | | | 153 | 12.72 | TCW | |
| 305 | 12.58 | TCW | | | 154 | 12.79 | TCW | |
| 304 | 12.28 | TCW | | | 155 | 12.83 | TCW | |
| 303 | 12.38 | TCW | | | 156 | 12.79 | TCW | |
| 302 | 12.30 | TCW | | | 157 | 12.80 | TCW | |
| 301 | 12.30 | TCW | | | 158 | 12.75 | TCW | |
| 300 | 12.32 | TCW | | | 159 | 12.75 | TCW | |
| 299 | 12.22 | TCW | | | 160 | 12.75 | TCW | |
| 298 | 12.20 | TCW | | | 161 | 13.75 | TCW | |
| 297 | 12.21 | TCW | | | 162 | 13.82 | TFG | |
| 296 | 12.25 | TCW | | | 163 | 13.82 | TFG | |
| 295 | 12.27 | TCW | | | 164 | 13.78 | TCW | |
| 294 | 12.30 | TCW | | | 165 | 13.85 | TCW | |
| 293 | 12.26 | TCW | | | 166 | 14.56 | TCW | |
| 292 | 12.47 | TCW | | | 167 | 14.55 | TCW | |
| 291 | 12.45 | TFG | | | 168 | 13.73 | TCW | |
| 290 | 12.43 | TFG | | | 169 | 13.73 | TCW | |
| 289 | 12.44 | TCW | | | 170 | 13.71 | TCW | |
| 288 | 12.94 | TCW | | | 171 | 13.71 | TCW | |
| 287 | 12.94 | TCW | To Veterans Hwy | | 172 | 17.49 | TCW | |
| **Mean:** | **12.70** | | | | 173 | 17.49 | TCW | |
| **High:** | **15.42** | | | | 174 | 17.26 | TCW | |
| **Low:** | **12.20** | | | | 175 | 14.37 | TCW | |
| **# of Obs.** | **58** | | | | 176 | 14.05 | TFG | |
| | | | | | 177 | 14.00 | TFG | |
| 274 | 12.88 | TCW | Veterans Hwy | | 178 | 14.04 | TFG | |
| 273 | 12.87 | TFG | | | 179 | 14.54 | TFG | |
| 272 | 12.87 | TFG | | | 180 | 14.53 | TCW | |
| 271 | 12.88 | TCW | | | 181 | 14.71 | TCW | |
| 270 | 12.70 | TCW | | | 182 | 14.22 | TCW | I-10 Bridge |
| 269 | 12.74 | TCW | | | **Mean:** | **13.84** | | |
| 268 | 12.77 | TCW | | | **High:** | **17.49** | | |
| 267 | 12.83 | TCW | | | **Low:** | **12.59** | | |
| 266 | 12.74 | TCW | | | **# of Obs.** | **37** | | |
| 265 | 12.77 | TCW | | | | | | |
| 264 | 12.65 | TCW | | | 183 | 14.25 | TCW | I-10 Bridge to |
| 263 | 12.66 | TCW | | | 184 | 14.20 | TCW | |
| 262 | 13.89 | TCW | | | 185 | 14.70 | TCW | |
| 261 | 13.88 | TCW | | | 186 | 14.62 | TCW | |
| 260 | 13.88 | TCW | | | 187 | 14.66 | TCW | |
| 259 | 13.88 | TCW | | | 188 | 13.11 | TCW | |
| 258 | 14.16 | TCW | | | 189 | 13.21 | TCW | |

## 17th Street Canal

| West side of Canal | | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | | **Point No.** | **Elev.** | **Code** | **Note** |
| 257 | 14.16 | TCW | | | 190 | 13.24 | TCW | |
| 254 | 14.33 | TCW | | | 191 | 13.25 | TCW | |
| 253 | 14.28 | TCW | | | 192 | 13.21 | TCW | |
| 252 | 14.32 | TCW | | | 193 | 13.28 | TCW | |
| 251 | 14.36 | TCW | | | 194 | 13.30 | TCW | |
| 250 | 13.29 | TCW | I-10 Bridge | | 195 | 13.27 | TCW | |
| **Mean:** | **13.38** | | | | 196 | 13.30 | TCW | |
| **High:** | **14.36** | | | | 197 | 13.32 | TCW | |
| **Low:** | **12.65** | | | | 198 | 13.24 | TCW | |
| **# of Obs.** | **23** | | | | 199 | 13.22 | TCW | |
| | | | | | 200 | 13.16 | TCW | Southern RR |
| 249 | 13.32 | TCW | I-10 Bridge to | | **Mean:** | **13.59** | | |
| 248 | 13.28 | TCW | | | **High:** | **14.70** | | |
| 247 | 13.30 | TCW | | | **Low:** | **13.11** | | |
| 246 | 13.37 | TCW | | | **# of Obs.** | **18** | | |
| 245 | 13.33 | TCW | | | | | | |
| 244 | 13.29 | TFG | | | | | | |
| 243 | 13.30 | TFG | | | | | | |
| 242 | 13.32 | TCW | | | | | | |
| 241 | 13.34 | TCW | | | | | | |
| 240 | 13.33 | TCW | | | | | | |
| 239 | 13.33 | TCW | | | | | | |
| 238 | 13.28 | TCW | | | | | | |
| 237 | 13.84 | TCW | | | | | | |
| 236 | 13.35 | TCW | | | | | | |
| 235 | 13.35 | TCW | | | | | | |
| 234 | 13.28 | TCW | Southern RR | | | | | |
| **Mean:** | **13.35** | | | | | | | |
| **High:** | **13.84** | | | | | | | |
| **Low:** | **13.28** | | | | | | | |
| **# of Obs.** | **16** | | | | | | | |

# Orleans Ave. Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| | | | | | | | **North End** |
| 45 | 13.02 | TCW | South Robert E. Lee Blvd. Bridge. | 230 | 12.98 | TCW | South Robert E. Lee Blvd. Bridge. |
| 46 | 13.40 | TCW | | 229 | 13.45 | TCW | |
| 47 | 13.44 | TCW | | 228 | 13.47 | TCW | |
| 48 | 13.21 | TCW | | 227 | 13.50 | TCW | |
| 49 | 13.23 | TCW | | 226 | 13.45 | TCW | |
| 50 | 13.19 | TCW | | 225 | 13.48 | TCW | |
| 51 | 13.17 | TCW | | 224 | 13.48 | TCW | |
| 52 | 13.03 | TCW | | 223 | 13.47 | TCW | |
| 53 | 13.04 | TCW | | 222 | 13.48 | TCW | |
| 54 | 13.21 | TCW | | 221 | 13.51 | TCW | |
| 55 | 13.17 | TCW | | 220 | 13.46 | TCW | |
| 56 | 13.66 | TCW | | 219 | 13.42 | TCW | |
| 57 | 13.74 | TCW | | 218 | 13.46 | TCW | |
| 58 | 13.23 | TCW | | 217 | 13.46 | TCW | |
| 61 | 12.74 | TCW | To Filmore Ave. Bridge. | 216 | 13.45 | TCW | |
| **Mean:** | **13.23** | | | 215 | 13.44 | TCW | |
| **High:** | **13.74** | | | 214 | 13.42 | TCW | |
| **Low:** | **12.74** | | | 213 | 13.43 | TCW | |
| | | | | 212 | 13.27 | TCW | |
| | | | | 211 | 13.26 | TCW | To Filmore Ave. Bridge. |
| 65 | 12.72 | TCW | South of Filmore Ave. Bridge. | **Mean:** | **13.42** | | |
| 68 | 13.27 | TCW | | **High:** | **13.51** | | |
| 69 | 13.72 | TCW | | **Low:** | **12.98** | | |
| 70 | 13.68 | TCW | | | | | |
| 71 | 13.16 | TCW | | | | | |
| 72 | 13.21 | TCW | | 196 | 13.84 | TFG | South of Filmore Ave. Bridge. |
| 73 | 13.27 | TCW | | 195 | 13.85 | TFG | |
| 74 | 13.07 | TCW | | 194 | 13.85 | TCW | |
| 75 | 13.08 | TCW | | 193 | 13.92 | TCW | |
| 76 | 13.08 | TCW | | 192 | 13.90 | TCW | |
| 77 | 13.14 | TCW | | 191 | 13.91 | TCW | |
| 78 | 13.18 | TCW | | 190 | 13.91 | TCW | |
| 79 | 13.23 | TCW | | 189 | 13.93 | TCW | |
| 80 | 13.16 | TCW | | 188 | 13.93 | TCW | |
| 81 | 12.98 | TCW | | 187 | 13.88 | TCW | |
| 82 | 12.98 | TCW | | 186 | 13.85 | TCW | |
| 83 | 13.98 | TCW | | 185 | 13.87 | TCW | |
| 84 | 14.06 | TCW | | 184 | 13.87 | TCW | |
| 85 | 14.49 | TCW | | 183 | 13.90 | TCW | |
| 86 | 14.49 | TCW | To North of Harrison Ave. Bridge | 182 | 13.87 | TCW | |
| **Mean:** | **13.40** | | | 181 | 13.84 | TCW | |
| **High:** | **14.49** | | | 180 | 13.88 | TCW | |
| **Low:** | **12.72** | | | 179 | 13.89 | TCW | |
| | | | | 178 | 13.79 | TFG | |
| | | | | 177 | 13.79 | TFG | |
| 96 | 13.48 | TCW | South of Harrison Ave. Bridge | 176 | 13.89 | TCW | |
| 97 | 14.02 | TCW | | 175 | 13.92 | TCW | |

# Orleans Ave. Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| 98 | 14.02 | TCW | | 174 | 13.87 | TCW | |
| 99 | 14.04 | TCW | | 173 | 13.39 | TCW | |
| 100 | 14.03 | TCW | | 172 | 13.32 | TCW | To North of Harrison Ave. Bridge |
| 101 | 13.59 | TCW | | **Mean:** | **13.83** | | |
| 102 | 13.75 | TCW | | **High:** | **13.93** | | |
| 103 | 13.63 | TCW | | **Low:** | **13.32** | | |
| 104 | 13.64 | TCW | | | | | |
| 105 | 14.16 | TCW | | | | | |
| 106 | 14.15 | TCW | | 162 | 13.32 | TCW | South of Harrison Ave. Bridge |
| 107 | 14.17 | TCW | | 161 | 13.31 | TCW | |
| 108 | 14.17 | TCW | | 160 | 13.86 | TCW | |
| 109 | 14.17 | TCW | | 159 | 13.89 | TCW | |
| 110 | 14.20 | TCW | | 158 | 13.87 | TCW | |
| 111 | 13.71 | TCW | | 157 | 13.84 | TFG | |
| 112 | 13.65 | TCW | | 156 | 13.85 | TFG | |
| 113 | 13.67 | TCW | | 155 | 13.90 | TCW | |
| 114 | 14.07 | TCW | | 154 | 14.00 | TCW | |
| 115 | 14.36 | TCW | | 153 | 13.36 | TCW | |
| 116 | 14.17 | TCW | | 152 | 14.00 | TCW | |
| 117 | 14.23 | TCW | | 151 | 13.93 | TCW | |
| 118 | 14.16 | TCW | | 150 | 13.91 | TCW | |
| 119 | 14.23 | TCW | | 149 | 14.00 | TCW | |
| 120 | 14.23 | TCW | | 148 | 14.05 | TCW | |
| 121 | 14.24 | TCW | | 147 | 14.04 | TCW | |
| 122 | 13.98 | TCW | | 146 | 14.00 | TCW | |
| 123 | 13.99 | TCW | To near Pumpstation #7 | 145 | 13.98 | TCW | |
| **Mean:** | **14.00** | | | 144 | 14.02 | ??? | To near Pumpstation #7 |
| **High:** | **14.36** | | | **Mean:** | **13.85** | | |
| **Low:** | **13.48** | | | **High:** | **14.05** | | |
| | | | | **Low:** | **13.31** | | |
| | | | | | | | |
| | | | | | | | |

# London Ave. Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| | | | | | | | **North End** |
| 62 | 13.12 | TCW | South Robert E. Lee Blvd. Bridge. | 328 | 12.4 | TCW | South of Leon C. Simon |
| 67 | 13.40 | TCW | | 327 | 12.9 | TCW | |
| 68 | 13.40 | TCW | | 326 | 12.8 | TFG | |
| 69 | 13.00 | TCW | | 325 | 12.8 | TFG | |
| 70 | 13.00 | TCW | | 324 | 12.9 | TCW | |
| 71 | 12.90 | TCW | | 323 | 12.9 | TCW | |
| 72 | 12.90 | TCW | | 322 | 12.9 | TCW | |
| 77 | 12.90 | TCW | | 321 | 12.9 | TCW | To Robert E. Lee Bridge |
| 78 | 12.90 | TCW | | **Mean:** | **12.82** | | |
| 79 | 12.90 | TCW | | **High:** | **12.94** | | |
| 80 | 12.90 | TCW | | **Low:** | **12.39** | | |
| 81 | 12.90 | TCW | | | | | |
| 82 | 12.87 | TFG | | | | | |
| 83 | 12.91 | TFG | | | | | |
| 84 | 12.91 | TCW | | 306 | 12.7 | TCW | South Robert E. Lee Blvd. Bridge. |
| 85 | 12.89 | TCW | | 305 | 12.7 | TCW | |
| 86 | 13.22 | TCW | | 304 | 12.7 | TCW | |
| 87 | 13.22 | TCW | To Filmore Ave. Bridge. | 303 | 13.0 | TCW | |
| **Mean:** | **13.01** | | | 302 | 13.0 | TCW | |
| **High:** | **13.40** | | | 301 | 13.0 | TCW | |
| **Low:** | **12.87** | | | 300 | 13.0 | TCW | |
| | | | | 299 | 13.0 | TCW | |
| | | | | 298 | 13.0 | TCW | |
| 93 | 13.00 | TCW | South of Filmore Ave. Bridge. | 297 | 12.5 | TCW | |
| 97 | 13.23 | TCW | | 296 | 12.5 | TCW | |
| 98 | 13.23 | TCW | | 294 | 12.4 | TCW | |
| 99 | 12.96 | TCW | | 293 | 12.5 | TCW | |
| 100 | 12.96 | TCW | | 292 | 12.5 | TCW | |
| 101 | 12.94 | TCW | | 291 | 12.5 | TCW | |
| 102 | 12.53 | ??? | | 290 | 13.0 | TCW | |
| 103 | 13.69 | TCW | | 289 | 13.0 | TCW | |
| 104 | 12.86 | TFG | | 288 | 13.0 | TCW | |
| 105 | 12.87 | TFG | | 287 | 13.0 | TCW | |
| 106 | 12.91 | TCW | | 286 | 13.1 | TCW | |
| 107 | 12.93 | TCW | | 285 | 13.1 | TCW | |
| 108 | 12.94 | TCW | | 284 | 12.9 | TFG | |
| 109 | 12.91 | TCW | | 283 | 12.9 | TFG | |
| 110 | 12.92 | TCW | | 282 | 13.0 | TCW | |
| 111 | 12.64 | ??? | | 281 | 13.0 | TCW | |
| 112 | 12.64 | TFG | | 280 | 13.3 | TCW | To Filmore Ave. Bridge. |
| 113 | 12.69 | TFG | | **Mean:** | **12.85** | | |
| 114 | 12.66 | TCW | | **High:** | **13.30** | | |
| 115 | 12.69 | TCW | | **Low:** | **12.44** | | |
| 116 | 12.69 | ??? | | | | | |
| 117 | 13.29 | TCW | | | | | |
| 118 | 13.29 | TCW | To North of Mirabeau Ave. Bridge | 273 | 12.4 | TCW | South of Filmore Ave. Bridge. |
| **Mean:** | **12.93** | | | 272 | 12.9 | TCW | |

# London Ave. Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| **High:** | **13.69** | | | 271 | 12.9 | TCW | |
| **Low:** | **12.53** | | | 270 | 12.4 | ??? | |
| | | | | 269 | 12.9 | TFG | |
| | | | | 268 | 12.9 | TFG | |
| 128 | 12.98 | TCW | South of Mirabeau Ave. Bridge | 267 | 13.0 | TCW | |
| 129 | 12.98 | TCW | | 266 | 13.1 | TCW | |
| 130 | 13.00 | TFG | | 265 | 12.9 | TCW | |
| 131 | 13.01 | TFG | | 260 | 12.5 | TCW | |
| 132 | 13.01 | TCW | | 259 | 12.9 | TCW | |
| 133 | 13.02 | TCW | | 258 | 12.9 | TCW | |
| 134 | 13.01 | TCW | | 257 | 12.8 | TFG | |
| 135 | 13.04 | TCW | | 256 | 12.8 | TFG | |
| 136 | 13.04 | TCW | | 254 | 13.1 | TCW | |
| 137 | 13.07 | TCW | | 253 | 13.3 | TCW | |
| 138 | 13.01 | TCW | | 252 | 13.3 | TCW | To North of Mirabeau Ave. Bridge |
| 139 | 12.97 | TCW | | **Mean:** | **12.88** | | |
| 140 | 12.90 | TCW | | **High:** | **13.31** | | |
| 141 | 12.85 | TCW | | **Low:** | **12.35** | | |
| 142 | 12.92 | TCW | | | | | |
| 143 | 12.80 | TCW | | | | | |
| 144 | 12.88 | TCW | | 241 | 13.4 | TCW | South of Mirabeau Ave. Bridge |
| 145 | 12.97 | TCW | | 240 | 12.8 | TCW | |
| 146 | 12.94 | TCW | | 239 | 12.9 | TCW | |
| 147 | 12.95 | TCW | | 238 | 12.9 | TCW | |
| 148 | 12.85 | TCW | | 237 | 12.9 | TFG | |
| 149 | 12.89 | TCW | | 236 | 12.9 | TCW | |
| 150 | 12.89 | TCW | | 235 | 12.9 | TCW | |
| 151 | 12.87 | TCW | | 234 | 13.0 | TCW | |
| 152 | 12.93 | TCW | | 233 | 13.0 | TCW | |
| 153 | 12.85 | TCW | | 232 | 13.0 | TCW | |
| 154 | 12.49 | TCW | To Gentilly Blvd. | 231 | 13.0 | TCW | |
| **Mean:** | **12.93** | | | 230 | 13.0 | TCW | |
| **High:** | **13.07** | | | 229 | 13.0 | TCW | |
| **Low:** | **12.49** | | | 228 | 13.0 | TCW | |
| | | | | 227 | 13.0 | TCW | |
| | | | | 226 | 12.9 | TCW | |
| 165 | 12.5 | TCW | South of Gentilly Blvd. | 225 | 12.9 | TCW | |
| 166 | 12.5 | TCW | | 224 | 12.9 | TCW | |
| 167 | 13.0 | TCW | | 223 | 13.0 | TCW | |
| 168 | 12.8 | TCW | | 222 | 12.9 | TCW | |
| 169 | 13.0 | TCW | | 221 | 13.0 | TCW | |
| 170 | 12.9 | TCW | | 220 | 13.0 | TCW | |
| 171 | 12.9 | TCW | | 219 | 12.5 | TCW | |
| 172 | 13.0 | ??? | | 218 | 12.9 | TCW | To Gentilly Blvd. |
| 173 | 12.9 | ??? | | **Mean:** | **12.94** | | |
| 174 | 12.9 | ??? | | **High:** | **13.40** | | |
| 175 | 13.0 | ??? | | **Low:** | **12.48** | | |
| 176 | 12.9 | TCW | | | | | |

# London Ave. Canal

| West side of Canal | | | | East side of Canal | | | |
|---|---|---|---|---|---|---|---|
| **Point No.** | **Elev.** | **Code** | **Note** | **Point No.** | **Elev.** | **Code** | **Note** |
| 177 | 12.9 | TCW | | | | | |
| 178 | 13.0 | TCW | | 217 | 12.9 | TCW | South of Gentilly Blvd. |
| 179 | 16.8 | TCW | | 216 | 12.9 | TCW | |
| 180 | 16.8 | TCW | | 215 | 12.9 | TCW | |
| 183 | 13.2 | TCW | | 214 | 12.9 | TCW | |
| 184 | 13.2 | TCW | | 213 | 12.9 | TCW | |
| 185 | 13.2 | TCW | To Pumpstation #3 | 212 | 13.0 | TCW | |
| **Mean:** | **13.34** | | | 211 | 13.0 | TCW | |
| **High:** | **16.79** | | | 210 | 12.9 | TCW | |
| **Low:** | **12.49** | | | 209 | 13.0 | TCW | |
| | | | | 208 | 12.9 | TCW | |
| | | | | 207 | 12.9 | TCW | |
| | | | | 206 | 13.0 | TCW | |
| | | | | 205 | 12.9 | TCW | |
| | | | | 204 | 12.5 | TCW | |
| | | | | 203 | 12.5 | TCW | |
| | | | | 202 | 16.8 | TCW | |
| | | | | 199 | 13.2 | TCW | |
| | | | | 198 | 13.2 | TCW | To Pumpstation #3 |
| | | | | **Mean:** | **13.12** | | |
| | | | | **High:** | **16.76** | | |
| | | | | **Low:** | **12.50** | | |
| | | | | | | | |
| | | | | | | | |

# Appendix 37
# IPET Supplemental Survey Scope of Work-10 Dec 05

**SUBJECT: IPET TASK GROUP 6-- SCOPE OF WORK for PHASE 2 AND PHASE 3 SURVEYS**

**Revision/Version Date: 10 December 2005 [BERGEN]**

Following is a scope of work for Phase 2 and Phase 3 elevation connections to flood control and hurricane protection (FC & HP) structures and other facilities in and around greater New Orleans. These surveys are required in support of other IPET Katrina performance assessment teams evaluating the performance of the existing (pre-Katrina) federal hurricane protection system, and indirectly to Task Force Guardian reconstruction efforts. Data from these surveys will be incorporated into models used by IPET Team 2/3 (Interior Drainage Models), Team 4/5 (Physical/Numerical Storm Surge Models), Team 8 (Pump Station Performance), and Team 10 (Engineering and Operational Risk and Reliability Analysis).

These connections include topographic/elevation surveys of high water marks, floodwalls, levees, pump stations, and bridges. Also included are connections to non-NOAA water level gages and calibration (ground truthing) of recently flown high & low altitude LIDAR mapping over FC & HP structures.

Field surveys are tentatively scheduled to commence on 5 Dec 05 and be completed on/before 31 Jan 06. These Phase 2 & 3 tasks will be performed before or concurrent with Phase 1 surveys (NOAA Tidal Benchmark DGPS connections), depending on contracted survey crew availability on site.

This scope is subject to modification during field survey operations in New Orleans; based on unforeseen site conditions, uncertain contract survey crew capabilities, funding restraints, and/or reprioritized IPET/TF Guardian requirements. Potential field modifications to this scope are shown in *[brackets]*.

Items shown as *[IPET Action]* are will be performed by Task Group 6 personnel, not the survey contractor.

## 1. SUPPORT TO TASK FORCE GUARDIAN [PRIORITY]

*[IPET Action]* Assessment of Constructed (Pre-Katrina) Flood/Hurricane Structure Elevations

Purpose: Develop relationship of older design & construction datums (eg, NGVD 29, Normal Water Surface) and current NAVD88 (LA VTDP 2004.65) and LMSL/LWRP protection elevations, to support on-going TF Guardian reconstruction, and subsequent settlement and loss of flood protection analysis. Provide survey and technical support to TF Guardian as required to evaluate on-going construction protection levels. *[Some of this support has already begun in the 17th Street Canal area with the CO-OPS installation of a new gage at the USCG Station.]*

## 2. GENERAL SURVEY PROCEDURES AND STANDARDS

Survey methods shall conform to the established engineering survey techniques used by the New Orleans District (MVN) in design & construction, and specifically to those methods currently being performed in support of Task Force Guardian. This includes profile density atop levees and floodwalls, breakline shots, static GPS TBM positioning, RTK surveys, recording procedures, and submittal requirements. Additional guidance on these procedures will be provided on site if needed. Most work will be performed using RTK survey methods; however, where more practical or necessary, total station trig elevations or conventional differential leveling methods may also be used. Recommended engineering & construction procedural criteria for GPS, RTK, differential leveling, and total station surveys are in EM 1110-1-1005 (Topographic Surveying--1 Jan 06 draft). A copy of this draft manual is available on site from Task Group 6 (Bergen).

### a. Performance/Accuracy Standards

Survey accuracy performance standards will generally conform to standard Engineering-Construction methods outlined in Section 4-3 (Accuracy Standards for Engineering and Construction Surveying) of EM 1110-1-1005.

### b. Reference Vertical Datum--NAVD88 (LA VTDP 2004.65)

Topographic and/or elevation surveys of levee/floodwall heights, gage sites, high water marks, bridges, pump stations, etc. will generally be observed from the nearest existing National Geodetic Survey (NGS) NAVD88 (LA VTDP 2004.65) BMs, or from TBMs established by static GPS connections (using current MVN methods) relative to this datum. The horizontal reference system is the Louisiana South Zone SPCS.

### c. Data Recording and Submittal

Survey data may be recorded in either a standard field book or data collector. Elevations will be recorded to the nearest 0.1 ft. Data submittal formats will conform to New Orleans District standards. Station descriptions on permanently set points shall follow New Orleans District formats, which include written and digital data. A master copy of this description standard is available from MVN (Huber).

### d. Supplemental TBM Control Points

Where no VTDP points are near the structure (eg, beyond RTK radio link range--3 miles ±), then temporary benchmark (TBM) points will be set using MVN static GPS survey methods being employed in support of Task Force Guardian. These TBMs may then be used to control supplemental topographic surveys using either RTK or conventional survey methods. MVN static surveys for new TBM points will be connected to, at minimum, the two (2) nearest recoverable NAVD88 (LA VTDP 2004.65) VTDP network benchmarks. Two 60-minute sessions from two VTDP points are required. The two sessions shall be performed on different days, and at different times on these days. GPS observing sessions shall be of sufficient length to obtain fixed baseline solutions.

TBMs should be set at optimum locations that will serve multiple structure sites.

TBM points will be set at sufficient density to set/check elevations on structures using conventional topographic survey methods [eg, RTK or total station].

A TBM is not needed if structure site is within RTK radio link range of an existing VTDP BM. (First floor elevations inside pump stations and some HWM points may require a nearby TMB to be set).

TBM points should be set near critical breach areas, floodwalls, high water marks, bridges, and pump stations that require detailed topographic surveys.

Occupy existing MVN levee control points (eg, PIs), NGS marks, or levee board control monuments for TBMs where practical. If none exist, then use concrete or like structures to mark a TBM. Capped rebar may also be used.

Obtain MVN database of existing levee control monuments (horizontal & vertical)—attempt to use these points if a new TBM needs to be set in an area.

A new description is required for permanently marked TBM points that are established. Follow MVN description and digital photo guidelines. A standard MVN monument description format will be provided.

Recovered VTDP points and TBM points require only brief field book descriptions.

Baselines will be reduced and adjusted by the contractor at the New Orleans field office, relative to the fixed NAVD88 (LA VTDP 2004.65) points. An OPUS solution on the new TBM point should be made as a QC check.

The *[2005 (?) revised/re-realized (?)]* Geoid03 model for the area will be used for RTK surveys extending from NAVD88 (LA VTDP 2004.65) points. *[The adequacy of this latest geoid model is uncertain for RTK site calibration/localization and will need to be verified by independent calibration checks ... or PPRTK if beyond radio link range]*

**e. General Procedures for Floodwall, Levee Profile, Pump Station, and MHW Surveys**

Elevation connections to various structures will originate from the nearest NAVD88 (LA VTDP 2004.65) or TBM points. Structure or HWM ties can be made by RTK, total station, or differential leveling methods, whichever is most efficient—using standard engineering/construction survey techniques, as outlined in EM 1110-1-1005.

Surveys should attempt to close between and/or back to VTDP marks or TBMs, where practical and feasible. RTK calibration checks should be performed at another VTDP or TBM point if possible. If no checks between adjacent VTDP BMs or TBMs are possible, then other RTK procedural QC methods may need to be performed—e.g., occupy points twice with at least 2 hours difference in time between observations, make RTK ties from two separate VTDP/TBM points, etc. Independent or separate RTK ties onto a topographic point should agree within ±0.1 ft.

*[Procedures for RTK surveys of some HWMs are TBD ... pending MVN criteria]*

**f. Checks against Existing VTDP Benchmarks**

When occupying one of the VTDP marks, a check survey on the marks stability should be made if practical. This can be accomplished by a rapid/fast static observation to another VTDP mark. Base station data should be logged for all RTK topographic sessions set up at a VTDP or TBM over one hour, and an OPUS solution computed for QC purposes. (The absolute accuracy of VTDP network points is estimated by NGS to be about ± 0.15 ft.—this should be considered in evaluating checks within the VTDP network. The relative accuracy of adjacent VTDP points is unknown--this could be obtained from the NGS if checks between VTDP points are questionable, or movement is suspected).

**g. Use of English Turn CORS for QC Checks**

*[Optional: If English Turn CORS orthometric elevation can be backed in from Phase 1a long-term static DGPS observations, then this point could be used as a QC check for TBM static surveys in this area (where fixed solutions on this baseline are obtained)].

### 3. HIGH WATER MARK SURVEYS

High water mark (HWM) surveys are required at the following 34 locations. The points in the St Bernard parish levee are higher priority in that cows may disturb the wooden stakes marking the HWMs. All these surveys should be completed ASAP in that the HWMs are considered perishable.

The point of contact for these surveys is Steve Maynord, CHL, 601-634-3284.

***[NOTE: Additional HWM points will be marked the week of 12 Dec by Maynord & Bergen at the Orleans Marina, based on visual observations by an individual who rode out the storm at the marina. These points will be provided later.]***

1. Lakefront Airport:
    a. Admin Building, room on Northwest corner of main lobby. High water mark is 3.1 ft above slab. Survey slab elevation. No mark placed on wall.

b. Estimate position of water level on sloping wall, mark point, and survey. Time = 0738.

c. Admin bldg, east side of upstairs deck on north side of bldg. Survey top of rail. Time = 0940.

d. Admin Bldg, northeast area, south side of damaged wall that is north of spiral staircase. Put mark on framework that plaster was attached to. Time = 0942.


e. Admin Bldg, northeast area, south side of damaged wall that is north of spiral staircase. Survey where water is on framework in picture. Time = 0955.

f. Admin bldg, northwest area, south side of damaged wall that is north of spiral staircase. Survey painted orange paint on white plaster wall. This photo was taken from the upstairs window on the northwest portion of the building. Ask surveyors to go upstairs and look at picture and orange mark to see if mark is correct. Time = 1031.

g. Admin Bldg, main lobby, column on east side but not near any wall that has electrical plug on it. Close to stairs with sign "Director Aviation". Survey slab below electrical plug. Time = 1105.

h. Admin Bldg, main lobby, column on east side but not near any wall that has electrical plug on it. Close to stairs with sign "Director Aviation". Survey slab below electrical plug. Time = 1208.


i. Building just east of Admin bldg. Survey top of lowest window. Time = 1251.

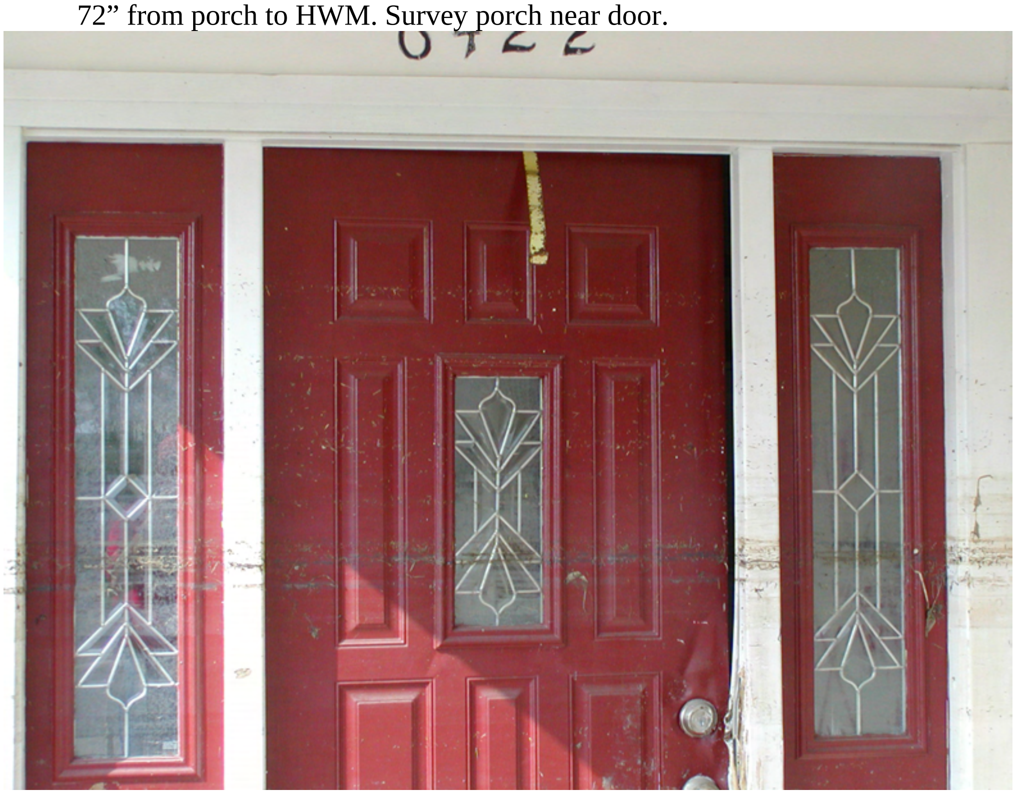
j. Building just west of Admin bldg with "Moffet" on side of bldg. Survey top of lowest window having red frames. Time = 1254.


k. Survey top of second step from top in picture. Time = 1621.

2. Pump station 3 at south end of London Canal- West side of pump station at floodgate opening for railroad. Arrow above gate sill on north side of gate. Survey arrow.

3. Pump station 6 at south end of 17th street canal- survey top of fronting protection at three points across north side of pump station that is about equal to floodwall elevations.

4. Interior points:
   a. 6422 peoples- 30 1.59’, 90 2.866’ - It is 35” from outside concrete slab to porch, 72” from porch to HWM. Survey porch near door.



b. 5438 St Ferdinand Drive- 30 0.925’, 90 2.617’- HWM is 99” above slab on front left corner of house. Survey slab.

c. 5544 St Ferdinand Dr- 30 0.975’, 90 2.692’, 95” above ground on right front side of house, marked with red arrow on plastic siding. Survey red arrow.

d. Corner of Peoples and Edge- 29 59.560’, 90 2.708’- HWM is 89” above step to front door on front porch. HWM is a black arrow on inside of front door frame on left side of door. Survey top of step to front door.

e. 2930 Florida Street- 29 59.104’, 90 2.528’- HWM is 92” above painted slab at door. Survey slab.


5. South St Bernard Parish Levee:
   a. EBI building on side away from floodwall. 29 51.783’,89 54.496’- HWM door is next to door marked office. HWM door has sign on it “no smoking”. Moved mark to outside of building on right side of HWM door. Marked with small black arrow about 4” below top of door. Survey HWM.
   b. HWM EL111105-1(north) and 2(south). Top of levee at 29 51.49’, 89 54.33’- Survey both debris points at stakes and top of levee. Record GPS of all three points. (This is to make sure we can keep north and south point locations correct).
   c. HWM EL111105-3(north) and 4(south). Top of levee at 29 51.25’, 89 54.22’- Survey both debris points at stakes and top of levee. Record GPS of all three points.
   d. HWM EL111105-5(north) and 6(south). Top of levee at 29 51.24’, 89 53.85’- Survey both debris points at stakes and top of levee. Record GPS of all three points.
   e. HWM EL111105-7(north) and 8(south). Top of levee at 29 51.24’, 89 53.37’- Survey both debris points at stakes and top of levee. Record GPS of all three points.
   f. HWM EL111105-9(north) and 10(south). Top of levee at 29 51.24’, 89 53.15’- Survey both debris points at stakes and top of levee. Record GPS of all three points.
   g. HWM EL111105-11(north) and 12(south). Top of levee at 29 51.25’, 89 52.27’- Survey both debris points at stakes and top of levee. Record GPS of all three points.

h. HWM EL111105-13(north) and 14(south). Top of levee at 29 51.25’, 89 51.36’- Survey both debris points at stakes and top of levee. Record GPS of all three points.

i. HWM EL111105- 15(south). (no mark found on north side). Top of levee at 29 51.24’, 89 50.77’- Survey debris point at south stake and top of levee. Record GPS of both points.

j. HWM EL111105-16(north) and 17(south). Top of levee at 29 51.25’, 89 50.27’- Survey both debris points at stakes and top of levee. Record GPS of all three points.

k. HWM EL111105- 18(south). (no mark found on north side). Top of levee at 29 51.25’, 89 49.52’- Survey debris point at south stake and top of levee. Record GPS of both points.

l. Survey top of levee with conventional level techniques to see if levee is low in this area. Survey every 200 ft for 1000 ft east and west of 29 51.25’, 89 49.38’.

m. HWM EL111105- 19(south). (no mark found on north side). Top of levee at 29 51.24’, 89 49.10’- Survey debris point at south stake and top of levee. Record GPS of both points.

n. HWM EL111105- 20(north). (no mark set on south side). Top of levee at 29 51.24’, 89 47.07’- Survey debris point at north stake and top of levee. Record GPS of both points.

o. HWM EL111105-21(north) and 22(south). Top of levee at 29 51.32’, 89 46.74’- Survey both debris points at stakes and top of levee. Record GPS of all three points.

## 4. PUMP STATION TOPOGRAPHIC SURVEYS (SUPPORT TO TASK GROUP 8)

Purpose: Elevation surveys are required to be able to calculate when and how much reverse flow did or could have occurred when the water level on the discharge side rises above the invert of the high point pump discharge waterway. Task Group 8 does not plan to provide any performance (flow) data for any Orleans Parish pump station rated below 1,000 cfs or any Jefferson Parish station rated below 900 cfs since these discharges represents less than 5% of the total for each parish; thus, surveys at these stations are not required.

First floor elevations are required on 63 pump stations, as indicated below.

The 6 priority stations in Orleans & Jefferson Parish (East Bank) shall be tied in first—highlighted in blue.

If available use as-built plans of the pump stations to indicate first floor elevation location(s). If as-builts are not available, show elevation location on a detailed field book sketch of the pump station facility. Note also any variable slab settlement.

Task Group 8 point of contact is Brian Moentenich, Hydroelectric Design Center--Portland, OR --503-808-4266.

# Pump Stations (~~63~~ 68 total)

**I) Orleans Parish**

**A) East Bank (E-3)**

| | |
|---|---|
| 1) OP 1 – PS 1 | 4640 cfs |
| 2) OP 2 – PS 2 | 3190 cfs |
| 3) OP 3 – PS 3 | 4140 cfs Note: inverts required ** |
| 4) OP 4 – PS 4 | 3680 cfs |
| 5) OP 5 – PS 5 | 2260 cfs |
| **6)** OP **6 – PS 6** | **9480 cfs** |
| 7) OP 7 – PS 7 | 2690 cfs Note: Inverts required ** |
| 8) OP 12 – PS 12 | 1000 cfs |
| 9) OP 19 – PS 19 | 3770 cfs |
| 10) Mont – Monticello | 9 cfs |

**B) East Bank (E-4a)**

| | |
|---|---|
| 1) OP 10 – PS 10 Citrus | 1000 cfs |
| 2) OP 14 – PS 14 Jahncke | 1200 cfs |
| 3) OP 16 – PS 16 St Charles | 1000 cfs |
| 4) OP 18 – PS 18 Maxent | 150 cfs |
| 5) OP 20 – PS 20 Amid | 500 cfs |
| 6) DR – Dwyer Rd | 120 cfs |
| 7) GS – Grant | 112 cfs |
| 8) Elai – Elaine St | 90 cfs |

**C) East Bank (E-4b)**

| | |
|---|---|
| 1) OP 15 – PS 15 | 750 cfs |

**D) West Bank (W-3b)**

| | |
|---|---|
| 1) OP 13 – PS 13 | 4650 cfs |

**E) West Bank (W-4b)**

| | |
|---|---|
| 1) OP 11 – PS 1 | 1530 cfs |

## II) Jefferson Parish

**A) East Bank (E-2)**

| | |
|---|---|
| **1)** PS **1 – Bonnabel** | **3750 cfs** |
| **2) PS 2 – Suburban** | **3040 cfs** |
| **3) PS 3 – Elmwood** | **3400 cfs** |
| **4)** PS **4 – Duncan** | **4800 cfs** |
| **5)** PS **5 – Parish Line** | **900 cfs** |

**B) West Bank (W-1)**

| | |
|---|---|
| 3) BS-PS – Bayou Segnette | 936 cfs |

**C) West Bank (W-2)**

| | |
|---|---|
| 1) A-PS – Ames | 1930 cfs |
| 2) W-PS – Westminister | 1200 cfs |
| 3) C2-PS – Cousins 2 | 2300 cfs |
| 4) E2-PS – Estelle 2 | 1140 cfs |
| 5) C1-PS – Cousins 1 | 960 cfs |
| 6) Harv-PS – Harvey | 960 cfs |
| 7) W2-PS – Westwego 2 | 936 cfs |

**D) West Bank (W-3)**

| | |
|---|---|
| 1) Hero-PS – Hero | 3902 cfs |
| 2) P-PS – Planters | 2360 cfs |

## III) St Bernard Parish

**A) East Bank (E-5a)**

| | |
|---|---|
| 1) F-1 – PS 1 Fortification | 1214 cfs |
| 2) M-4 – PS 4 Meraux | 1214 cfs |
| 3) JL-6 – PS 6 Jean Lafitte | 1003 cfs |
| 4) BD-7 – PS 7 Bayou Ducros | 1003 cfs |
| 5) SM-8 – PS 8 St Mary | 836 cfs |
| 6) BV-3 – PS 3 Bayou Villere | 501 cfs |
| 7) G-2 – PS 2 Guichard | 724 cfs |
| 8) EJG-5 – PS 5 E.J. Gore | 668 cfs |

## IV) Plaquemines Parish

A) East Bank

| | |
|---|---|
| 1) Scarsdale | 1780 cfs |
| 2) Belair | 130 cfs |
| 3) Bellevue | 516 cfs |
| 4) Point A La Hache (East) | 516 cfs |

**B) West Bank (W-4a)**

| | |
|---|---|
| 1) BC-1 – Belle Chase 1 | 3556 cfs |
| 2) BC-2 – Belle Chase 2 | 990 cfs |

C) West Bank

| | |
|---|---|
| 1) Ollie | 300 cfs |
| 2) Upper Ollie | 250 cfs |
| 3) Lower Ollie | 120 cfs |
| 4) Point A La Hache (West) | ??? cfs |
| 5) Diamond | 256 cfs |
| 6) Hayes | 500 cfs |
| 7) Gainard Woods | 408 cfs |
| 8) Sunrise 1 | 200 cfs |
| 9) Sunrise 2 | 290 cfs |
| 10) Grand Liard (Buras) | 840 cfs |
| 11) Duvic (Venice) | 560 cfs |
| 12) Wilkinson (Private) | ??? cfs |
| 13) Pointe Celeste (Private) | ??? cfs |

The following pump stations ~~may be added later~~ have been added (9 Dec 05—Bergen). ~~They should not be tied in unless advised~~.

| | |
|---|---|
| Plaquemines Parish: | |
| Braithwaite | ???cfs |
| Barreire | ???cfs |
| Orleans Parish: | |
| I-10 | 860cfs |
| PS OP #17 (Sta. D) | 625cfs |
| Pritchard | ???cfs |

** PUMP STATION INVERT ELEVATIONS (LONDON AVE & ORLEANS CANALS)

Elevations of inverts on discharge side of pumps (cut in highest point on bottom of the discharge tube ... may need to hit top point and apply diameter for invert? Do not rely entirely on as-builts at these sites, even if available). [No backflow prevention at these sites. $17^{th}$ St not included ... had backflow valves at this station.]. NOTE: This duplicates work required under the surveys of 63 pump stations previously described ... the difference being invert elevations are required at these facilities.

## 5. ELEVATION TIES TO FC & HP STRUCTURES

Purpose and Location of Work. To obtain updated NAVD88 (LA VTDP 2004.65) and related water surface elevations on FP & HP structures and facilities in the greater New Orleans metropolitan area (Orleans, Jefferson, St. Bernard, St. Charles, and Plaquemines Parishes), in and around the following projects, as outlined in the IPET Scope of Work:

Lake Pontchartrain, LA and Vicinity Hurricane Protection Project (HPP). The project lies between the Mississippi River and Lake Pontchartrain, and is located in St. Bernard, Orleans, Jefferson, and St. Charles Parishes in southeast Louisiana, (generally the greater New Orleans metropolitan area), and also includes a mitigation dike on the west shore of the lake. The project includes:

- New levee from the Bonnet Carré Spillway East Guide Levee to the Jefferson-St. Charles Parish boundary
- Floodwall along the Jefferson-St. Charles Parish line
- Enlarged levees along the Jefferson and Orleans Parish lakefronts
- Parallel protection (levees, floodwalls, and flood proofed bridges) along the 17th Street, Orleans Avenue, and London Avenue outfall canals
- Levees from the New Orleans lakefront to the Gulf Intracoastal Waterway (GIWW)
- Enlarged levees along the GIWW and Mississippi River-Gulf Outlet (MR-GO)
- New levee around the Chalmette Area.

The West Bank and Vicinity, New Orleans, LA, HPP. The project is located in Orleans, Jefferson and Plaquemines Parishes, and in metropolitan New Orleans on the west bank of the Mississippi River. The project includes:

- 22 miles of earthen levee and 2 miles of floodwall extending from the Harvey Canal south to the V-levee near the Jean Lafitte National Historical Park and back up to the town of Westwego.
- The Lake Cataouatche area eliminated the west-side closure in Westwego, and added about 10 miles of levee and 2 miles of floodwall
- The East of Harvey Canal area has a sector floodgate in the Harvey Canal and about 25 miles of levee and 5 miles of floodwall.

The New Orleans to Venice, LA, HPP. This project is located along the east bank of the Mississippi River from Phoenix, Louisiana, (28 miles southeast of New Orleans) down to Bohemia, Louisiana, and along the west bank of the river from St. Jude, Louisiana, (39 miles southeast of New Orleans) down to the vicinity of Venice, Louisiana.

The Grande Isle and Vicinity (Larose to Vicinity of Golden Meadow) HPP. *[TBD]*

*[Private levees in various Parishes--Requirements TBD]*

### a. General Procedures for FC & HP Elevation Profile Surveys

Low altitude LIDAR mapping of levees and floodwalls throughout the area was flown by Furgo- Chance in 2005. The estimated vertical accuracy of this mapping is *[± ?? ft]*. High altitude LIDAR mapping was also performed by the JALBTCX after Katrina, with an estimated relative accuracy of ± 0.5 ft. All mapping/DEMs being used by the IPET models needs need to be checked to ensure consistency with the NAVD88 (LA VTDP 2004.65) datum.

Levee and floodwall elevation profile surveys are required throughout the projects listed above. Although some 300 miles of FC & HP structures are represented, it is anticipated that many of these structures will not require detailed profile surveys; or they may have already been profiled by Task Force Guardian crews. Specific projects will be prioritized on site, in coordination with MVN and TF Guardian work currently underway. Elevations will be referenced to the NAVD88 (LA VTDP 2004.65) and LMSL/LWRP reference datums.

The primary survey effort will be to validate and/or calibrate the elevation models obtained from recent low-altitude LIDAR mapping. Selected shot points atop levees, floodwalls, or nearby flat surfaces throughout the region will be surveyed for comparison with the low-altitude LIDAR DEMs. The number of verification (or ground truthing) test points that must be surveyed will depend on the field survey comparison results. If the checks are within acceptable tolerances, then field survey efforts can be greatly minimized and the LIDAR mapping can be deemed sufficiently accurate for other IPET model studies. If the checks are outside tolerance, then a sufficient number of additional ground calibration points will have to be observed to recalibrate/adjust the DEM; or a full levee profile survey will have to be performed.

Profiling will not be required in areas where low-altitude LIDAR mapping adequately and accurately defined the levee profile elevation. This adequacy and accuracy will be verified in near real-time by ground truthing verification surveys. This is especially important in the long levee reaches in St Bernard and Plaquemines Parishes—verifying that the LIDAR mapping is adequate/accurate will eliminate detailed conventional profiling surveys.

*[IPET Action: All of the above assumes that the low-altitude LIDAR mapping was processed at a high post-spacing resolution sufficient to detail the floodwall caps and levees. This needs to be verified. If the LIDAR data was not processed at a high resolution, then reprocessing may be needed]*

**b. Accuracy and Tolerance Criteria**

Elevations will be observed and recorded to the nearest 0.1 ft. Accuracies should generally be within ±0.2 ft, relative to the nearest VTDP network points. Floodwall elevations should be more accurately surveyed than earthen levees.

Tolerance checks for low-altitude LIDAR mapping should generally fall within *[±0.25 ft]* on floodwall caps and *[±0.5 ft]* on earthen levees.

**c. Prior MVN Control and Levee/Floodwall Surveys**

Coordinate with MVN (Huber) to ensure recent District surveys supporting TF Guardian are not duplicated; and to utilize control points already established by these prior surveys. Most, if not all, of the floodwalls in the 17th Street, London Ave, and Orleans Canals have been surveyed. Check for work already accomplished on the Lake Pontchartrain floodwall, the IHNC, and other breach areas to the southeast towards Venice.

*[IPET Action: Obtain (from Task Group 1(?) as-built drawings for all FC & HP structures ... hard copy drawings are needed for field survey crews, along with hard-copy MVN general location project maps]*

## 6. Ground Truth Checks on Low-Altitude (Furgo-Chance) LIDAR Mapping

This low-altitude LIDAR mapping was obtained before the revised VTDP elevations were released by NGS; thus, field calibration checks are needed.

Verification point shot density should be every lineal *[0.5 mile or mile]* along levee profile flight line *[or a minimum of 3]* points along a flight line. If field checks are within acceptable tolerances of the LIDAR DEM, then check point spacing may be increased; the assumption being that the PP/DGPS vertical control along that particular flight line was good throughout. If field checks are outside the acceptable tolerance (Furgo-Chance LIDAR flight lines only), then continue at the original spacing ... or even smaller if the checks are not consistent. Presumably this check data can be applied to the original LIDAR or DEM to correct elevation errors ... if they are consistent. Otherwise, the levee/floodwall will need to be fully profiled. *[LIDAR map testing to FGDC/ASPRS standards may need to be performed if results are inconsistent.]*

Procedures:

- Utilize existing VTDP and TBM points set for other subtasks to maximum extent practical
- Obtain check points when occupying VTDP or TBMs for other subtasks.
- Verify LIDAR imagery/DEM post-spacing density adequately picked up tops/caps of narrow floodwalls.
- Obtain LIDAR mapping flight lines from the original sources. Check points only within this imagery. Have imagery on a laptop in the field when selecting check points.
- Select flat, open points easily discerned on aerial/LIDAR imagery models—eg, tops of levees, parking lots, road intersections. Obtain a sufficient number of points over the flat area to define a planer surface ... ie, 3+ points, but should be recorded.
- Primarily interested in ground truthing (checking) vertical alignment—horizontal not as critical.
- Check Furgo-Chance DEMs in near real-time ... in field or office.

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## 7. Ground Truth Checks on High-Altitude (JALBTCX) LIDAR Mapping

In an effort to facilitate consistent model results in the New Orleans area, checkpoint surveys, described in FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners [April 2003] – Appendix A: Guidance for Aerial Mapping and Surveying*, are needed to provide ground truth control.

Six potential locations for collecting checkpoint survey data near the south shore of Lake Pontchartrain are shown on the figure below. These check surveys can be jointly performed while set up for other subtasks in the vicinity.

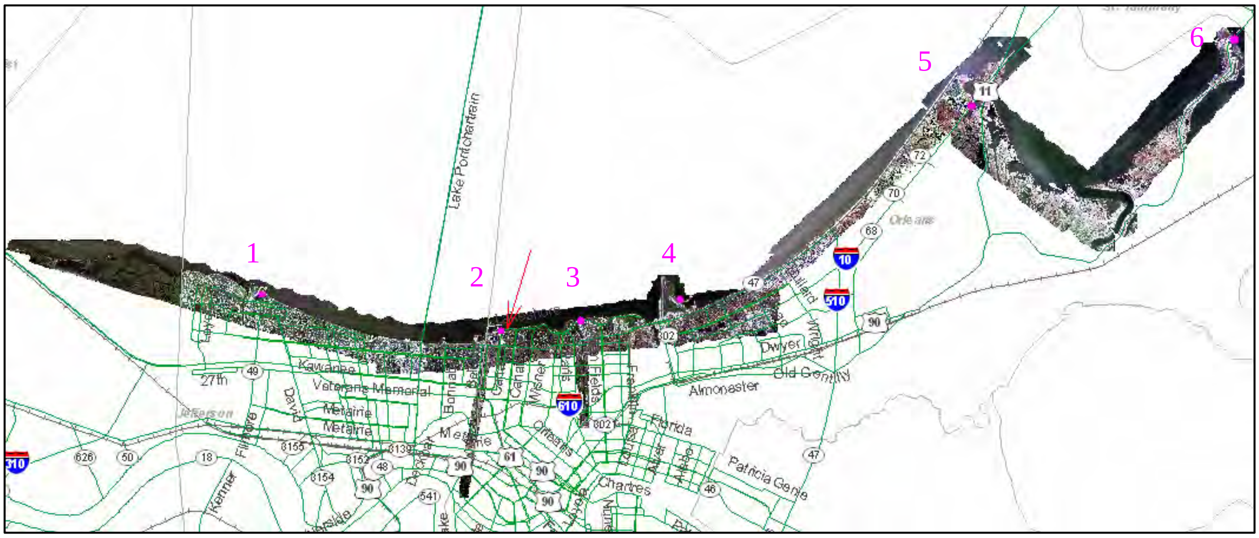


Figure 1: CHARTS Data Coverage Along Lake Pontchartrain South Shore and Along Levees in New Orleans.

Figure 1. Figure 1 shows the extents of data collection by CHARTS in this area. While CHARTS collected additional data outside the area shown in Figure 1, potential patch areas for those locations will be provided at a later date.

For reference in Figure 1, the red arrow is pointing to the vicinity of monument ALCO (PID BJ1342). The six magenta dots indicate the approximate locations where patch areas are desired. These patch locations will provide valuable ground truth information for the CHARTS data and have high potential of being included within others' data collection efforts. Additional images are available at larger scales for the six potential locations—these will be furnished to the contractor separately.

A sufficient number of X-Y-Z points in each patch area shall be obtained to define both a vertical plane and sharp breaklines for checking the horizontal orientation. Where possible, take some check points in different terrains—paved concrete/asphalt, grass, etc. For additional information regarding these locations and checkpoint procedures, please contact Eddie Wiggins (JALBTCX) at 228-252-1103.

Surveys of these calibration "checkpoints" should follow the guidance in FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners [April 2003] – Appendix A: Guidance for Aerial Mapping and Surveying*. Part of this guidance is excerpted below. A complete copy is available from Bergen.

*Checkpoints are normally surveyed with transections or small clusters of points, at least two of which have been surveyed using GPS relative to NSRS monuments that have both Ellipsoid Order and Vertical Order specified on their NGS data sheets. If selected monuments are farther than 20 kilometers (36 miles) from the test areas to be surveyed, the assigned Mapping Partner shall establish Secondary Base Stations so that final surveys of checkpoints satisfy NGS-58 requirements for Local Network accuracy of 5-centimeters at the 95-percent confidence level.*

*Alternatively, the assigned Mapping Partner may use GPS real-time-kinematic (RTK) procedures provided the following conditions are met:*

*1. The base station is an existing NGS three-dimensional mark or a new NGS-58 mark,*
*2. RTK procedures are used only in open areas and each RTK point is occupied twice with at least 2 hours' difference in time between observations, and Section A-28 A.6.*
*3. The difference between observations does not exceed 5 centimeters.*

*The assigned Mapping Partner may use third-order conventional surveys to extend control from GPS "anchor points" to other transection or cluster points, especially when checkpoints are in forested areas where GPS signals are blocked.*

*When checkpoints are to be used for QA/QC reviews of digital elevation data (e.g., TINs, DEMs), the checkpoints must be at least 5 meters away from any breakline where there is a change in slope. Such checkpoints must be on flat or uniformly sloping terrain. The assigned Mapping Partner shall take photographs to record the location of the checkpoint relative to its surroundings, and to verify the vegetation category within which the checkpoint is located. The Mapping Partner shall mark each checkpoint with a 60d nail or larger. The Mapping Partner shall write the station ID number on an adjacent above-ground stake within 1 foot of the referenced stake, to aid in subsequent recovery if required during the course of the Flood Map Project. The Mapping Partner shall use "to reach" location descriptions and photographs to document the location, the land cover surrounding each stake, and the uniform slope of the terrain surrounding each stake.*

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## 8. SUPPORT TO ERDC/COASTAL HYDRAULICS LAB— TASK GROUP 4 (NUMERICAL STORM SURGE & WAVE MODELS)

The following surveys are required to support ERDC-Coastal Hydraulics Lab model studies.

[Contact Mr. Maynord at CHL Vicksburg 601-634-3284 if questions on specific line items herein]

### 8-1. BRIDGE SURVEYS (ORLEANS, LONDON AVE & 17TH ST CANALS):

- Obtain low chord elevations on all street bridges crossing these canals
- Topo flood protection connectors between bridge and floodwalls

### 8-2. BRIDGE SURVEYS (Three (3) RAILROAD BRIDGES OVER IHNC)

a. Obtain low chord elevations —down position ... (bridges were down at Katrina event)

b. Survey bottom of opening at railroad crossing/opening in floodwall (floodgate W-30) at west side of IHNC just south of I-10.

### 8-3. IHNC PRIVATE LEVEE/FLOODWALL

Survey elevations along private floodwall/levee and connections with mainline levee at Sealand/Maersk on west side of IHNC, south of I-10. Survey and document dimensions of any failures or changes in elevation. Conduct survey between each end where this private floodwall/levee ties into the main line of protection. (Portions of this levee failed during Katrina).

### ~~8-4. IHNC LOCK (STAFF GAGE)~~ (Requirement Deleted)

~~Lock at confluence of MRGO/IWW & IHNC. Gage BM recently tied in by MVN to NAVD88 (LA VTDP 2004.65). Need to tie in to LMSL (2005). May be of use in short-term water elevation transfer check to New Canal and/or LaBranche gages. .~~

### ~~8-5. I-10 LAKE PONTCHARTRAIN BRIDGE RECORDING GAGES~~

~~Tie in two gages to NAVD88 (LA VTDP 2004.65) and LMSL (2005) ... one USGS and the other Orleans Levee District. (Gages were running before/during Katrina ... still operational? Local gage datums uncertain. Specific gage locations on I-10 bridge unknown).~~

### ~~8-6. PUMP STATIONS (LONDON AVE & ORLEANS CANALS)~~ [See Subtask 4 above]

~~Elevations of inverts on discharge side of pumps (cut in highest point on bottom of the discharge tube ... may need to hit top point and apply diameter for invert? Do not rely entirely on as-builts at these sites, even if available). [No backflow prevention at these sites. 17th St not included ... had backflow valves at this station.]. NOTE: This duplicates work required under the surveys of 63 pump stations previously described ... the difference being invert elevations are required at these facilities.~~

## 8-7. GAGE CONNECTION SURVEYS

The following gages need to be connected to NAVD88 (2004.65) and LMSL.

**1) USGS at I-10 and Inner Harbor Navigation Canal**

**2) Orleans Levee District Gage at same general location as above**

**3) USGS gage at Paris Road (I510) bridge over IWW**

**4) Orleans Levee District gage at Southshore Marina**

**5) Pass Manchac at Turtle Cove at Pontchatoula, LA**

**6) Little Irish Bayou near HWY 11 near Slidell, LA**

**7) National Weather Service gage at North Shore and Causeway. This gage was moved after the hurricane ... may not be possible to establish a datum for the old gage.**

Details and contacts regarding these gages have not been researched at this time. Will possibly need to make contact with USGS and Orleans Levee Board. MVN POC is Ms. Nancy Powell.

---

***[IPET Actions]* The following miscellaneous tasks have not been defined by Task Group 6 to date**

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**VTDP ties to Original Construction Benchmarks**

Obtain MVN construction drawings from IPET web site and locate control used for original construction. Connect these marks to the VTDP reference.

**MVN Collected HWM Database**

Verify collected data is referenced to NAVD88 (LA VTDP 2004.65). Reference Klaus 21 Oct 05 e-mail. (Ken Klaus, MVD 601-634-7122).

"The MVN database for HWM and the IPET data base in the new orleans vicinity I am working are the same. Nancy Powell of MVN hydraulics and I are working together in developing the database. I have attached the latest file showing data. According to Nancy Powell the point numbers in red such as LA1171 have been surveyed in epoch 2004.65. The points with black letters such as LA1004 were surveyed prior to the determination that we would use epoch 200465. According to Nancy Powell, the District is going to have these earlier points adjusted/resurveyed to reflect 200465. Will you ask Mark Huber if I am correct that the District will adjust these earlier points to 200465? If not we have many more points to add to our effort." Steve Maynord

**MISSISSIPPI RIVER GAGES ... TIES TO NAVD88 (LA VTDP 2004.65) & LWRP (19XX)**

Purpose: To establish the relationship between NAVD88 (LA VTDP 2004.65) and the local protection levee design elevations (LWRP).

- Connect *[six]* recording gages along Mississippi River reach from New Orleans to Venice.
- Coordinate with MVN for specific LWRP (19XX) reference and BM locations.
- Perform MVN static DGPS ties to two nearest NAVD88 (LA VTDP 2004.65) marks, *[unless already done by MVN (Huber) at some sites]*.
- Relate LWRP (19XX) & NAVD88 (LA VTDP 2004.65) to designed/constructed levee elevations.
- In lower reaches, determine relationship between LWRP (19XX), NAVD88 (LA VTDP 2004.65), MLG (19??), and MLLW/MSL (2005), as applicable.
- Define specific LWRP-MLG-MLLW transition points throughout reach.
- Need POC in MVN or MVD for LWRP design relationship.
- Mean Low Gulf datum vs. Mean Gulf Level datum ... two distinct datums used by MVN (Nancy Powell)
- LMVD not defined/updated below New Orleans

# Appendix 38
# ETL 1110-2-349 Coastal MLLW Datum
# 1 Apr 93

CECW-EP

DEPARTMENT OF THE ARMY
U. S. Army Corps of Engineers
Washington, D.C. 20314-1000

Engineer Technical Letter
No. 1110-2-349

1 April 1993

# Engineering and Design
# REQUIREMENTS AND PROCEDURES FOR REFERENCING COASTAL NAVIGATION PROJECTS TO MEAN LOWER LOW WATER DATUM

## 1. Purpose.

This engineer technical letter (ETL) provides guidance, technical considerations, and general implementation procedures for referencing coastal navigation projects to a consistent Mean Lower Low Water (MLLW) datum based on tidal characteristics defined and published by the U.S. Department of Commerce. This guidance is necessary to implement applicable portions of Section 224 of the Water Resources Development Act of 1992.

## 2. Applicability.

This ETL applies to HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities (FOA) having responsibilities for design of river and harbor navigation projects on the Atlantic, Gulf, and Pacific coasts, and where such projects are subject to tidal influence.

## 3. References.

*a.* Rivers and Harbors Appropriation Act of 1915 (38 Stat. 1053; 33 U.S.C. 562).

*b.* Water Resources Development Act of 1992 (WRDA 92), Section 224, Channel Depths and Dimensions.

*c.* ER 1130-2-306, Navigation Lights, Aids to Navigation, Navigation Charts, and Related Data Policy, Practices and Procedures.

*d.* ER 1130-2-307, Dredging Policies and Practices.

*e.* EM 1110-2-1003, Hydrographic Surveying.

*f.* EM 1110-2-1414, Water Levels and Wave Heights for Coastal Engineering and Design.

*g.* Tidal Datum Planes, Special Publication 135, U.S. Department of Commerce.

*h.* Manual of Tide Observations, Publication 30-1, U.S. Department of Commerce.

*i.* Tide and Current Glossary, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*j.* Statement of Work for the Installation, Operation and Maintenance of Tide Stations, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*k.* User's Guide for the Installation of Bench Marks and Leveling Requirements for Water Level Stations, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*l.* The National Tidal Datum Convention of 1980, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

## 4. Background.

*a.* Depths of USACE navigation projects in coastal areas subject to tidal influences are currently referred to a variety of vertical reference planes, or datums. Most project depths are referenced to a local or regional datum based on tidal phase criteria, such as Mean Low Water, Mean Lower Low Water, Mean Low Gulf, Gulf Coast Low Water Datum, etc. Some of these tidal reference planes were originally derived from U.S. Department of Commerce, National Ocean Service (NOS) observations and definitions used for the various coasts (see references 3g and 3i). Others were specifically developed for a local project and may be without reference to an established vertical network (e.g. National Geodetic Vertical Datum of 1929) or a tidal reference. Depending on the year of project authorization, tidal epoch, procedures, and the agency that established or connected to the reference datum, the current adequacy of the vertical reference may be uncertain, or in some cases, unknown. In some instances, project tidal reference grades may not have been updated since original construction. In addition, long-term physical effects may have significantly impacted presumed relationships to the NOS MLLW datum.

*b.* The National Tidal Datum Convention of 1980 (reference 31) established one uniform, continuous tidal datum for all marine waters of the United States, its territories, and Puerto Rico. This convention thereby lowered the reference plane (and tidal definition) of both the Atlantic and Gulf coasts from a mean low water datum to a MLLW datum. In addition, the National Tidal Datum Epoch was updated to the 1960-1978 period and mean higher/high water datums used for legal shoreline delineation were redefined.

*c.* Since 1989, nautical charts published by the Coast and Geodetic Survey (C&GS), U.S. Department of Commerce, reference depths (or soundings) to the local MLLW reference datum, also termed a "chart datum." U.S. Coast Guard (USCG) Notices to Mariners also refer depths or clearances over obstructions to MLLW. Depths and clearances reported on USACE project/channel condition surveys provided to C&GS, for incorporation into their published charts in plan or tabular format, must be on the same NOS MLLW reference as the local chart of the project site.

*d.* WRDA 92, Section 224, requires consistency between USACE project datums and C&GS marine charting datums. This act amended Section 5 of the Rivers and Harbors Appropriation Act of 1915 (reference 3a) to define project depths of operational projects as being measured relative to a MLLW reference datum for all coastal regions. (Only the Pacific coast was previously referenced to MLLW). The amendment states that this reference datum shall be as defined by the Department of Commerce for nautical charts (C&GS) and tidal prediction tables (NOS) for a given area. This provision requires USACE project reference grades be consistent with NOS MLLW.

## 5. Impact of MLLW Definition on USACE Projects.

*a.* Corps navigation projects that are referenced to older datums (e.g., Mean Low Water along the Atlantic coast or various Gulf coast low water reference planes) must be converted to and correlated with the local MLLW tidal reference established by the NOS. Changes in project grades due to redefining the datum from mean low water to NOS MLLW will normally be small, and in many cases will be compensated for by offsetting secular sea level or epochal increases occurring over the years. Thus, impacts on dredging due to the redefinition of the datum reference are expected to be small and offsetting in most cases.

*b.* All Corps project reference datums, including those currently believed to be on MLLW, must be checked to insure that they are properly referred to the latest tidal epoch, and that variations in secular sea level, local reference gage or benchmark subsidence/uplift, and other long-term physical phenomena are properly accounted for. In addition, projects should be reviewed to insure that tidal phase and range characteristics are properly modeled and corrected during dredging, surveying, and other marine construction activity, and that specified project clearances above grade properly compensate for any tidal range variances. Depending on the age and technical adequacy of the existing MLLW reference (relative to NOS MLLW), significant differences could be encountered. Such differences may dictate changes in channels currently maintained. Future NOS tidal epoch revisions will also change the project reference planes.

*c.* Conversion of project datum reference to NOS MLLW may or may not involve field tidal observations. In many projects, existing NOS tidal records can be used to perform the conversion, and short-term simultaneous tidal comparisons will not be required. Tidal observations and/or comparisons will be necessary for projects in areas not monitored by NOS or in cases where no recent or reliable observations are available (see references 3e and 3h).

## 6. Implementation Actions.

A number of options are available to USACE commands in assessing individual projects for consistency and accuracy of reference datums, and performing the necessary tidal observations and/or computations required to adequately define NOS MLLW project reference grade. Datum establishment or verification may be done using USACE technical personnel, through an outside Architect-Engineer contract, by another Corps district or laboratory having special expertise in tidal work, or through reimbursable agreement with NOS. Regardless of who performs the tidal study, all work should be closely coordinated with both the C&GS and NOS in the Department of Commerce.

*a. Technical Specifications.* The general techniques for evaluating, establishing, and/or transferring a tidal reference plane are fully described in the USACE and Department of Commerce publications referenced in paragraph 3. These references should be cited in technical specifications used for a tidal study contract or reimbursable agreement with another agency/command.

*b. Department of Commerce Contacts.* Before and during the course of any tidal study, close coordination is required with NOS. The NOS point of contact is the Chief, Ocean and Lake Levels Division, National Ocean Service (ATTN: N/OES2), 6001 Executive Blvd., Rockville, MD 20852, telephone (301) 443-8807, FAX (301) 443-1920.

*c. Sources.* If in-house forces are not used, the following outside sources may be utilized to perform a tidal study of a project, including any field tidal observations.

(1) Architect-Engineer (A-E) Contract. A number of private firms possess capabilities to perform this work. Either a fixed-scope contract or indefinite delivery type (IDT) contract form may be utilized. In some instances, this type of work may be within the scope of existing IDT contracts. Contact NOS to obtain a typical technical specification which may be used in developing a scope of work. The references in paragraph 3 of this letter must be cited in the technical scope of work for the A-E contract.

(2) Reimbursable Support Agreement. Tidal studies and datum determinations may be obtained directly from the NOS, Department of Commerce, via a reimbursable support agreement. A cooperative agreement can be configured to include any number of projects within a district. Funds are provided to NOS by standard inter-agency transfer methods and may be broken down to individual projects. Contact the Chief of the Ocean and Lake Levels Division at the address given in paragraph 6b to coordinate and schedule a study agreement.

*d. Scheduling of Conversions.* Section 224 of WRDA 92 did not specify an implementation schedule for converting existing projects to NOS MLLW (or verifying the adequacy of an existing MLLW datum). It is recommended that a tidal datum study be initiated during a project's next major maintenance cycle.

*e. Funding.* No centralized account has been established to cover the cost of converting projects to NOS MLLW datum. Project O&M funds will be used to cover the cost of tidal studies and/or conversions on existing projects. For new construction, adequate funding should be programmed during the initial planning and study phases. Budget estimates for performing the work can be obtained from NOS.

*f. MLLW Relationship to National Vertical Network.* Reference 3k prescribes requirements for connecting USACE tidal bench marks to the national vertical network maintained by C&GS; either the National Geodetic Vertical Datum, 1929 Adjustment (NGVD 29) or the updated North American Vertical Datum, 1988 Adjustment (NAVD 88). Project condition surveys, maps, reports, studies, etc. shall clearly depict the local relationship between MLLW datum and the national vertical network.

*g. Changes in Dredging.* It is not expected that the datum conversion will significantly impact dredging requirements. USACE commands should request HQUSACE guidance should a datum conversion cause a significant change in a channel's maintained depth.

## 7. Proponency.

The proponent for this technical letter is the Engineering Division, HQUSACE. Any comments regarding improvements and/or clarifications should be submitted to HQUSACE, ATTN: CECW-EP-S, 20 Massachusetts Ave., NW, Washington, D.C. 20314-1000.

FOR THE DIRECTOR OF CIVIL WORKS:

PAUL D. BARBER, P.E.
Chief, Engineering Division
Directorate of Civil Works

# Appendix 39
# Monument Memo

8 Feb 95

Discussed w/ Vic Landry 2/23/9 and Steve Spencer 2/29 [initials]

**17TH ST. OUTFALL CANAL**
**HISTORY OF SURVEYS USED FOR CONSTRUCTING FLOODWALLS AND CANAL DREDGING**

MAR-APR 1987

Walker & Avery performed surveys for the NOS&WB using PBM "Disk T-193" with Elev. 9.741 NGVD to establish TBM "USCE Monument 14", El. 8.77 NGVD

(NOTE: The elevation of the PBM used by Walker & Avery cannot be verified by NOD's Survey Section. No such elevation exists in the historical data for this PBM)

TBM "USCE Monument 14", El. 8.77, was used to design and construct the floodwalls on both sides of the canal as well as for the canal dredging.

JAN 1995

Surveys for the Hammond Hwy Gates were performed by NOD using TBM "Pump Station 1", El. -0.02 NGVD and establishing TBM "USCE Monument 14", at El. 8.32. (The elevation of TBM "USCE Monument 14" established by NOD is 0.45 ft. lower than the elevation established by Walker & Avery).

The elevation of TBM "Pump Station 1" was established during previous NOD surveys using PBM "ALCO 1931", El. 7.375 NGVD (1964 epoch).

The elevation of TBM "USCE Monument 14" was double checked by running a level from PBM "North Gate 2", located on the New Basin Canal Pump Station, El. 11.48 NGVD (1964 Epoch). TBM "USCE Monument 14" was found to be at El. 8.29 NGVD (-0.03 ft. lower than the original NOD surveys of Jan 95).

From these data, it appears that the floodwalls on both sides of the canal were constructed approx. 5.5 inches lower than the elevations indicated on the P&S for these walls.

The I-walls were supposed to have been constructed with 6 inches of allowable settlement. Instead, the walls were constructed with only approx. 0.5 inch overbuild.

Also, the Veterans Hwy Bridges were designed using surveys performed by Walker & Avery, using PBM "Disk T-193" with Elev. 9.741 NGVD. The design elevations for the bridges should be checked for adequacy.

APRIL 1972

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

# VERTICAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
SEA-LEVEL DATUM OF 1929

QUAD 300902 PAGE NO. 18
LOUISIANA
LATITUDE 30°00' to 30°30'
LONGITUDE 90°00' to 90°30'
DIAGRAM BATON ROUGE NH 15-6

DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY
Form 686 A

## RECOVERY NOTE, BENCH MARK

R

Designation CANAL
State Louisiana
County Orleans
Nearest town New Orleans
County Orleans
Distance and direction from nearest town At New Orleans
Character of mark A disk
Stamping CANAL 1938 -3.071
Established by U.S.E.O. & W.B.
Present condition Good
Recovered as Described 1963
Detailed report At New Orleans, near the center of the neutral ground of Canal Boulevard between Harrison Avenue and French Street, 47 feet east of the east curb of the west lane of Canal Boulevard, 142 feet north of the north curb of French Street, in the top of a 25-foot concrete 10 by 10-inch pile with top about 2 feet below the surface of the ground surrounded by a brick retaining wall and covered with a 2-foot cast iron manhole lid cast "DRAIN".

-3.708

LINE 108

## DESCRIPTION OF BENCH MARK

Designation T 193
State Louisiana
County Jefferson
Nearest town Metairie
County Jefferson
Chief of party R. Gerrish
Distance and direction from nearest town 2.0 miles east
Leveling date 1/64
Character of mark A C&GS Bench Mark Disk
Stamping T 193 1964
Established by C&GS
Detailed description About 2.0 miles east along the Veterans Memorial Highway from its intersection with North Causeway Blvd. at Metairie, near the Orleans-Jefferson Parish Line, 0.4 mile west along Veterans Memorial Highway from the junction of Pontchartrain Blvd in Orleans Parish, set on the top of the north end of the west concrete abutment of the Veterans Memorial Highway bridge over the 17 th Street Canal, 16 feet north of the center line of the east-bound lane of the highway, 15 feet southwest of the east end of the north guard rail of bridge and ½ foot above the level of the highway.

9.741 1965

## DESCRIPTION OF BENCH MARK

Designation S 193
State Louisiana
County Jefferson
Nearest town Metairie
County Jefferson
Chief of party R. Gerrish
Distance and direction from nearest town 1.3 miles east
Leveling date 1/64
Character of mark A C&GS Bench Mark Disk
Stamping S 193 1964
Established by C&GS
Detailed description About 1.3 miles east along the Veterans Memorial Highway from its intersection with North Causeway Blvd. at Metairie, between William David Parkway and Sena Drive, set on the top of the east end of the south concrete head wall of a double 8-foot box type culvert under the highway, 28.5 feet south of the center line of the east-bound lane of the Veterans Memorial Highway, 115 feet west of the center line of William David Parkway, 0.8 foot west of the east end of the head wall and about level with the highway.

-1.949

## DESCRIPTION OF BENCH MARK

Designation R 193
State Louisiana
County Jefferson
Nearest town Metairie
County Jefferson
Chief of party R. Gerrish
Distance and direction from nearest town 0.6 mile east
Leveling date 1/64
Character of mark A C&GS Bench Mark Disk
Stamping R 193 1964
Established by C&GS
Detailed description About 0.6 mile east along Veterans Memorial Highway from its intersection with North Causeway Blvd. at Metairie, about 65 yards west of the junction of Veterans Memorial Highway and Hesper Avenue, set on the top of the south end of the west concrete abutment of an 80-foot bridge over Bannabel Canal, 22 feet south of the center line of the east-bound lane of the highway, 9 feet east of the west end of the south guard rail of the bridge and ½ foot above the level of the highway.

2.487

## DESCRIPTION OF BENCH MARK

Designation Q 193
State Louisiana
County Jefferson
Nearest town Metairie
County Jefferson
Chief of party R. Gerrish
Distance and direction from nearest town 0.4 mile east
Leveling date 1/64
Character of mark A C&GS Bench Mark Disk
Stamping Q 193 1964
Established by C&GS
Detailed description About 0.4 mile east along the Veterans Memorial Highway from its intersection with North Causeway Blvd. at Metairie, at the intersection of Veterans Memorial Highway and Metairie Heights Avenue, set on the top of the west end of the south concrete abutment of a 75 foot long Metairie Heights Avenue Bridge over Elmwood Canal, 54 feet north of the center line of the east-bound lane of the Veterans Memorial Highway, 17 feet west of the center line of Metairie Heights Drive, 9 feet north of the south end of the east bridge guard rail and about 1 foot above the level of the highway.

-.771

## DESCRIPTION OF BENCH MARK

Designation Y 189
State Louisiana
County Jefferson
Nearest town Metairie
County Jefferson
Chief of party R. Gerrish
Distance and direction from nearest town At Metairie
Leveling date 1/64
Character of mark A C&GS Bench Mark Disk
Stamping Y 189 1964
Established by C&GS
Detailed description At Metairie, at the intersection of Veterans Memorial Highway and North Causeway Blvd., set on the top of the west end of the south concrete abutment of the 75 foot long North Causeway Blvd. bridge over Elmwood Canal, 42 feet north of the center line of the east-bound lane of the Veterans Memorial Highway, 17 feet west of the center line of the south-bound lane of the North Causeway Blvd., 9 feet north of the south end of the bridge guard rail and about ½ foot above the level of the Blvd.

-.495

# Appendix 40
# Historical Timeline

C O P Y

U. S. DEPARTMENT OF COMMERCE
COAST & GEODETIC SURVEY
WASHINGTON 25, D. C.

In Reply address the Director
Coast & Geodetic Survey
and not the signer of this
letter
And Refer to No. 651-mc

Your file: LMNGS

10 April 1958

TO: District Engineer
New Orleans District
Corps of Engineers, U. S. Army
P. O. Box 267
New Orleans, Louisiana

Subject: Leveling in the Vicinity of New Orleans

Receipt is acknowledged of your letter of 27 February 1958, pertaining to the adjustment of leveling in the vicinity of New Orleans, Louisiana. The adjusted results for the 1955 releveling were published under date of 10 October 1957, copy of which is enclosed for your file.

The releveling of 1951 was undertaken as a reimbursable assignment and due to limited funds and also due to other commitments, we were not in a position to extend the leveling into more stable areas as we would have liked to have done. The releveling of 1955 which was extended both east and west of New Orleans brought out the fact that marks in New Orleans were settling by varying amounts.

In your letter of 5 January 1956 to Comdr. Robert A. Earle, Coast and Geodetic Survey, New Orleans, you stated that bench marks 1326/02.68 (USE), U 8, and A 10 appeared to be less reliable than most of the other marks. Yet our leveling shows these marks to have settled less than those referred to in your recent letter as being on stable structures.

In the adjustment of leveling, we try as far as possible to avoid changing previously adjusted values. However, where the changes in elevation are appreciable, the releveling would be unduly punished to fit it to previously adjusted values. We realize that changed elevations cause inconvenience to local engineers but the matter of settlement has been noted in a good many areas. Releveling in the vicinity of Galveston and Houston has shown that there is considerable change in this region, with a maximum of about 2.8 feet in the vicinity of Texas City. Other regions of settlement have been noted east of Little Rock, Arkansas, and in many regions of California. In fact, the more releveling that is accomplished, the more we lean toward the belief that there is no mark which can be trusted to remain absolutely stable and that any mark may undergo some change due to adjustments in the earth's crust. The setting of marks in substantial structures does not always guarantee their stability because often the changes are deep seated.

It is believed that until we have additional releveling to give us a better understanding of what changes have taken place in your region of interest, we should retain the adjusted elevations as published in the list enclosed. It is realized that often less confusion results by retaining the old elevations by local engineers and if this is the case

Incl. 2

COPY

in your instance, there are certainly no objections to your retaining previous values for your local use. In fact, field work by the U.S.E. accomplished around 1938 should be tied to our 1938 elevations and not the most recent elevations.

/s/ Charles Pierce
Charles Pierce
Rear Admiral, C&GS
Assistant Director

Enclosure (1)

12840 NOTICES

NATIONAL VERTICAL CONTROL NET

Proposed Action

MAY 7, 1973.

Elevations of marked points (benchmarks) in the National Vertical Control Net are based on the "Sea Level Datum of 1929." Since this datum was derived from the overall average sea, level of 26 tide stations, the official elevation at any particular one of these tide stations does not necessarily reflect the actual local "mean sea level." In order to avoid such apparent confusion and the costly errors that may result through failure to consider local sea level when engineering projects are undertaken, it is proposed to change the present name of the vertical control datum from the "Sea Level Datum of 1929" to the "National Geodetic Vertical Datum of 1929." This change is proposed to be effective on or before July 2, 1973. Comments on this proposed action may be directed to the Director, National Ocean Survey, NOAA, Rockville, Md. 20852.

ROBERT M. WHITE, Administrator.

[FR Doc.73-9694 Filed 5-15-73; 8:45 am]

FEDERAL REGISTER, VOL. 38, NO. 94-WEDNESDAY, MAY 16, 1973

DAEN-CWE-DC
DAEN-MPE-S

DEPARTMENT OF THE ARMY
Office of the Chief of Engineers
Washington, D. C. 20314

ETL 1110-1-97

Engineer Technical
Letter No. 1110-1-97

31 October 1978

Engineering and Design
CHANGE IN NAME OF NATIONAL VERTICAL CONTROL NET

1. Purpose. The purpose of this letter is to inform Corps of Engineers personnel of the change in nomenclature of vertical datum used on topographic maps.

2. Applicability. This ETL is applicable to all field operating agencies having Civil Works and/or Military Construction responsibilities located within the United States.

3. References.

a. Federal Register, V. 38, No. 94, May 16, 1973, page 12840

b. Federal Register, V. 41, No. 96, May 17, 1976, page 20202

4. Discussion. Elevations of marked points (benchmarks) in the National Vertical Control Net are based on the "Sea Level Datum of 1929." Since this datum was derived from the overall average sea level of 26 tide stations, the official elevation of any particular one of these tide stations does not necessarily reflect the actual local "mean sea level." To avoid the implication that vertical control datum elevations are referenced to a condition which may vary from one location to another, the National Ocean Survey has redesignated the "Sea Level Datum of 1929" as the "National Geodetic Vertical Datum of 1929," reference paragraph 3 above.

5. Action. All new maps, revisions or documents whose elevations are those of the National Vertical Control Net will make reference to "National Geodetic Vertical Datum of 1929" rather than "Sea Level Datum of 1929."

FOR THE CHIEF OF ENGINEERS:

for Frank R. Thompson
HOMER B. WILLIS
Chief, Engineering Division
Directorate of Civil Works

To: LMVED
Cf: ~~LM~~ District File

14 NOV 78

DEPARTMENT OF THE ARMY
LOWER MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI 39180

REPLY TO ATTENTION OF: LMVED-TS

9 FEB 79

SUBJECT: Change in Name of National Vertical Control Net

District Engineer, St. Louis
District Engineer, Memphis
District Engineer, Vicksburg
District Engineer, New Orleans

1. References:

a. ETL 1110-1-97, 31 Oct 78, subject as above.

b. LMVED-CM M/L, 15 Sep 78, subject as above (Incl 1).

2. The purpose of this letter is to clarify the intent of the referenced ETL. The change in nomenclature of the vertical control datum should be reflected on all new correspondence, design memorandums, survey reports, plans and specifications, maps, and other reports and engineering documents.

3. You should take appropriate action to insure that the "National Geodetic Vertical Datum of 1929" (NGVD) is used in lieu of "Sea Level Datum of 1929" (msl) to identify the vertical control datum on all new documents as discussed above.

FOR THE DIVISION ENGINEER:

1 Incl
as

Robert I Kaufman
ROBERT I. KAUFMAN
Acting Chief, Engineering Division

# DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

K Copy to Mr Soileau, Mr Piccola & Mr Harrington & Mr Smithin (I'd like to meet w/ them as a group.) Carlos M. Evans

| REFERENCE OR OFFICE SYMBOL | SUBJECT | |
|---|---|---|
| LMVED-A | Subsidence of Coastal Louisiana | |
| TO C/Plng Div | FROM C/Eng Div | DATE 30 Nov 81 Kaufman/eb/5902 — CMT 1 |

1. During the 16-18 Nov 81 Coastal Engineering Research Board meeting at LMVD, the Board indicated that the following factors may influence subsidence either real or suggested, and therefore need additional investigation:

   a. Settlement of permanent benchmarks.

   b. Earthquakes and/or faulting.

   c. Withdrawal of subsurface minerals, such as oil, gas, and water.

2. It is suggested that these factors be included in any ongoing studies of coastal Louisiana which address the present or projected future amount or condition of coastal resources which are affected by subsidence.

R
RESTA

CF:
Mr. Khatry
Mr. Weaver
Mr. WR Hill

12/9/81

Met w/ above today. Established the an ad hoc group chaired by Mr Piccola. First step to be literature research in the various areas of responsibility. Mr Piccola to report to me in 60 days.

DA FORM AUG 80 2496 — PREVIOUS EDITIONS WILL BE USED

Eames
Your comments by early Friday please on thought & Scenario.

S: - 6 Apr 84

LMVED-TS

JOHNSON/ajw/
E

SUBJECT: Datum Changes in Southern Louisiana

W. R.

Commander, New Orleans District

R

HA

1. On 10 Apr 84, Mr. David B. Zilkoski, Chief of the Vertical Analysis Section, National Geodetic Survey in Rockville, MD, will be in Vicksburg to brief General Read and his staff on the recently completed leveling and adjustment work on the Vertical Datum in the Gulf Coast area. As these level adjustments will affect projects in your area of concern, you and members of your staff are requested to attend the briefing.

COL

2. The briefing will begin at 10:00 a.m. in the Vicksburg District Main Conference Room on the fourth floor of the Crawford Street Post Office Building.

GEN

3. In addition to the briefing on 10 Apr, there will be an informal "round-table" discussion among members of the LMVD staff and Mr. Zilkoski during the afternoon of 9 Apr 84. This discussion will begin at 1:00 p.m. in Room 206 of the Walnut Towers Building. You are encouraged to attend this discussion also. A tentative list of attendees for both meetings should be furnished by 6 Apr 84.

4. My point of contact for these activities is Mr. Frank N. Johnson. Mr. Johnson can be reached at EXT. 5935 for additional information.

FOR THE COMMANDER:

R. H. RESTA, P.E.
Chief, Engineering Division

AGENDA

BRIEFING FOR MG READ ON DATUM
CHANGES IN SOUTHERN LOUISIANA
Lower Mississippi Valley Division Office
Vicksburg, MS
10 April 84

Tuesday - 10 April 1984 (Post Office Building , Room 402)

10:00 a.m.........Welcome and Opening Remarks by General Read, Introduction of Mr. Zilkoski to group by Mr. Frank Johnson

10:10 a.m.........Presentation of Briefing by Mr. Zilkoski (NGS)

10:40 a.m.........Question and Answer Period

* 10:50 a.m.........Presentation by Mr. Harrington (NOD) - Specific Problems In the NOD related to Datum Adjustments

11:15 a.m.........Floor Open For General Discussion

12:00 a.m.........LUNCH

1:00 to 3:00 p.m.........Conference Room Available if needed

*Introduce Mr. Harrington

Note: Tom! This is tentative only, and may be adjusted later, however, I believe this is basically the way it will go.

FACSIMILE HEADER SHEET
(ER 105-1-5)

| FROM (Name) | OFFICE SYMBOL | TELEPHONE NO. | RELEASER'S SIGNATURE | | |
|---|---|---|---|---|---|
| Frank N. Johnson | LMVED-TS | EX. 5935 | Frank N. Johnson | | |
| TO (Name) | OFFICE SYMBOL | TELEPHONE NO. | PAGES | PRECEDENCE | DTG |
| Tom Harrington | LMNED-M | EX. 2592 | 1 | Priority | 3Apr84 |

FORM 460 1 FEB 73

5 Space from top

9-10 apr 84

NGVD Change

Meeting of COE with NGS
9-10 Apr84, Vicksburg, Miss.

Thoughts

Time Considerations

1. Past
2. Present
3. Future 50 year-100 year

Sources of Change

1. Consolidation of overburden 50,000'±
2. Mineral removal
3. Sea Level change
4. Bedrock subsidence
5. Loss of overbank building by sediments
6. Survey corrections and adjustments

Where

1. Coastal lands
2. Continental shelf
3. River valleys
4. Uplands
5. Metropolitan-cities-urban-countryside

How

1. Straightline
2. Progressive
   a. accelerating
   b. deceleration
3. Site specific
4. Sudden

Projects impacted

1. Projects in place.
2. Projects under construction
3. Projects under design
4. Future projects
5. Concerns not specifically related to projects but of concern.
   a. FIA
   b. Gages

Types of Projects

1. Flood Control
   a. Levees
   b. Drainage canals
   c. Pumping stations
   d. Drainage structures
   e. Combinations

Organizations Concerned

1. Federal - COE, SCS, FIA, USCG, etc.
2. State
3. Local governments
4. Public
5. Private
6. General public

2. Navigation
   a. Deepdraft
   b. Shallow draft
   c. Structures
   d. Combinations

3. Freshwater Diversion
   a. Dilution
   b. Wildlife

Datum Planes

| | | |
|---|---|---|
| MSL | ] | How defined |
| MSG | ] | How established |
| NGVD | ] | How monitored |
| | | Reference point(s) |

NGVD Network

1. How run
2. Computer techniques
3. Future methodology & outlook

Engineering Disciplines Concerned

| | | |
|---|---|---|
| Hydraulics | - | Flowlines<br>Gages<br>Storage areas<br>Tidal surges<br>Sea level |
| Foundations | - | Stability (F of S)<br>Geology |
| Design | - | Levee Floodwall grades<br>Pile penetrations<br>Structural adequacies |
| Surveying | - | Benchmarks<br>Gages |
| Drafting | - | Mapmaking |

Scenario: NGVD Change Impacts on Levee Status

Problem: Generally along the Mississippi River Levees and Atchafalaya Basin Levees the change in the datum is about .5 foot.

Discussion:

1. An analysis of the impacts is complex because of the following factors:

a. Is the flowline falling at the same rate as the ground is subsiding?

b. Is the change in channel capacity a function of the datum change or other factors, primarily degradation of the channel cross section the reason for the increase?

c. What are the tidal influences and what is the extent of sea level change?

2. a. These major main stem levees are ________ miles long (_______ MRL; Atch W, E, & R). Using the current flowline and datum, ________ miles of MRL and ________ miles of Atchafalaya levees were below grade. A .5 foot adjustment would have ________ miles of MRL and _______ miles of Atchafalaya Levees below grade.

b. While we do not undertake raising of earthen levees of less than 1 foot to restore freeboard, we do have areas now on the order of .5 to .9 foot too low and the .5 foot adjustment will equal or exceed 1 foot.

c. Because of poor foundation conditions and restricted areas, we have and are continuing to construct floodwalls as part of the protective system. Corrections to sheet pile walls, while undesirable is possible, but usually correction to T-walls will result in overstress or non-correction to higher flood frequency overtopping.

d. Both of these levee systems contain flood control structures. On the Mississippi we have the overbank, low, sill, auxiliary and lock structures at Old River; Morganza structure and floodway, Bonnet Carre structure; Harvey, Algiers and IHNC Locks, and soon Caernarvon Structure. The state also has Empire Lock. In the Atchafalaya system we have by Sorrel, Berwick, Beouf Locks, Charenton floodgate, E & W Columet floodgates, and Upper Pointe Coupee Control Structure, Wax Lake West Control Structure and ________ pumping stations. Because of a recent adjustment in flowline, several of these facilities may require modification or replacement. Any datum change will accentuate the need for replacement or modification.

3. Our concerns for the protective system are accuentated if the prediction are for continued settlement. If a steady but relatively slow settlement continues, then in all probability, devwelopment within the protected area will continue and we will continue to raise the protective system to protect the improvements.

Mr. Harrington/jes/2592

LMNED-S 2 November 1984

SUBJECT: NGS Bench Marks

Commander, Lower Mississippi Valley Division

1. Reference is made to the meeting in LMVD on 10 Apr 84; and on 24 Oct 84 in the New Orleans District, relative to the above subject. Reference is also made to discussion between Admiral Bosler, NOAA, Mr. Resta, and the undersigned on this years low water trip.

2. The 1983 adjustments have been formally promulgated by the NGS. Before we begin to use the adjustments, we believe a discussion with NGS, preferably to include Admiral Bosler, would be useful. In particular, we would like to better understand the NGS methodology and its implications.

3. As set forth in the meeting on 24 Oct 84, the new adjustments do have significant implications for a number of our projects.

4. To provide some insight as to the implications of the new adjustments insofar as our projects are concerned, I have enclosed plots comparing prior elevations of NGS bench marks with those that result from application of the new adjustments. (Encls 1 and 2.)

5. We recommend that a meeting as described in paragraph 2 be arranged at the earliest practicable date.

2 Encl

FREDERIC M. CHATRY
Chief, Engineering Division

CHATRY
LMNED

CF: LMNED-SS

JOHNSON/dw/5935
ED-TS

MARCH 05, 1985

DUBUISSON
ED-TS

Engineering Division

GRISHAM
ED-TL

SUBJECT: Adjustments to NGS Bench Marks

MISKELLEY
ED-TD

RA John D. Bossler
Director, Charting and
Geodetic Services, NOAA
U.S. Department of Commerce
Rockville, MD 20852

W. R. HILL
ED-T

Dear Admiral Bossler:

WEAVER
ED-G

The results of the NGS 1983 adjustments to the Vertical Datum in the Gulf Coast area have been formally published and the new adjustments have significant implications for a number of our projects. Of particular concern to this office are those adjustments which result in changes in elevation to bench marks in South Louisiana and the potential effects on flood control and hurricane protection works in that area.

KAUFMAN
ED-R

A preliminary study performed by the New Orleans District which compares prior elevations of NGS bench marks with elevations resulting from the 1983 adjustments indicate a general lowering of elevations along the Mississippi River in the southern half of the state. Based on the data analyzed, a maximum rate of settlement of -0.06 feet per year in certain areas has been determined. This rate of settlement could result in a deficiency in top elevation of over one foot for some of our facilities in only 20 years.

LOUQUE
ED-W

KAUFMAN
ED-A

In view of the implications to existing facilities and possible changes to projects in the planning and design stage, we would appreciate at your earliest convenience any information you could give us concerning the level of confidence that can be expected from the 1983 adjustments before we begin using this new elevation data in current projects and before initiating any modifications to existing facilities.

BAYLEY
PD

GRAHAM
RE

FOR THE COMMANDER:

J. HILL
CO

R. H. RESTA, P.E.
Chief, Engineering Division

RESTA
ED

CF:
LMNED
DAEN-ECE-B (Mr. Miles)

HASCOTT
ED-T (FOR CF)

Comeback
~~Mr. Agostinelli~~
Mr. Johnson
27 Mar 84

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF CHARTING AND GEODETIC SERVICES
ROCKVILLE, MARYLAND 20852

MAR 29 1985

Mr. R. H. Resta, P.E.
Chief, Engineering Division
U. S. Army Corps of Engineers
Lower Mississippi Valley Division
P.O. Box 80
Vicksburg, Mississippi 39180-0080

Dear Mr. Resta:

In response to your letter dated March 5, 1985, I can assure you that we place a very high level of confidence in the 1983 Gulf Coast area adjustment results. We believe they are the best available heights for the region. However, as an engineer you realize the importance of the assumptions imposed when the adjustment was performed and their impact on the adjusted results.

Specifically, the Lousiana Gulf Coast is an unstable region of the country. As you know, the entire area is subsiding. I have enclosed two publications which estimate the crustal movements in this area (see enclosures 1 and 2). The subsidence varies substantially throughout the region, but as the reports indicate, the subsidence tends to increase from north to south. This increases the complexity of data analysis and adjustment constraints.

The following scenario was developed for the 1983 Gulf Coast adjustment. First, a primary network, consisting of leveling data observed from 1968 to 1982, was adjusted. This assumed that no significant movements occurred between surveys. In this area, there most likely was a small amount of bench mark movement between surveys. However, it is difficult to estimate the true magnitude of these movements without additional releveling. These primary heights were then used to constrain the secondary network. The assumption was made that the secondary network was displaced in the same manner as the primary. In most subsidence areas, crustal movement rates vary considerably. Once again, a more accurate estimate of these movement rates cannot be determined without additional surveys.

As stated earlier, we have high confidence in the adjustment results under the assumptions stated above. The adjusted heights from the area adjustment are the best available estimates for the Gulf Coast region. It should be noted that the assumptions made for this adjustment were necessary because the Gulf Coast vertical network was not designed specifically to monitor subsidence.

In the past, when National Geodetic Survey (NGS) performed leveling and adjustments in this area, the new leveling was forced to fit previously published values of the existing network. The constraints imposed in these past adjustments arbitrarily biased the results such that "true" movement could not be detected when adjusted height differences were compared. This is the reason adjusted heights should not be used when estimating subsidence. Repeat leveling and/or special adjustments provide the best estimates of crustal motion.

In some subsiding areas, special networks have been established to estimate crustal motion. The Houston-Galveston, Texas, area is a good example (see enclosures 3,4, and 5). The NGS has designed a subsidence plan, called the Geocadastre, for the Louisiana Gulf Coast. Messrs. Gilbert J. Mitchell and David B. Zilkoski, of my staff, briefed the New Orleans District and the Greater New Orleans Planning Council in November 1984. Enclosure 6 describes the Geocadastre in detail.

In conclusion, the major problem in the area is that the Gulf Coast vertical network is not intended to provide detailed crustal motion information. However, we still believe the heights from the 1983 Gulf Coast area adjustment are the best obtainable at this time. We also believe that the Geocadastre is a means of more confidently estimating subsidence in the area. Mr. Mitchell, (301) 443-8143, and Mr. Zilkoski, (301) 443-8567, are available to meet with you to discuss the Geocadastre, the Gulf Coast adjustment, or other special analyses to meet specific project needs. I am pleased that we can participate in this joint effort to better assess your agency's requirements of the geodetic network.

Sincerely yours,

John

John D. Bossler
Rear Admiral, NOAA
Director
Charting and Geodetic Services

Enclosures

DEPARTMENT OF THE ARMY
LOWER MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
P. O. BOX 80
VICKSBURG, MISSISSIPPI 39180-0080

REPLY TO
ATTENTION OF:

LMVED-TS 12 APR '85

SUBJECT: Adjustments to NGS Bench Marks

Commander, New Orleans District
ATTN: LMNED-S

The inclosed letter from Rear Admiral Bossler to Mr. Resta concerning the 1983 Gulf Coast area adjustments to Bench Marks is furnished for your information.

FOR THE COMMANDER:

for ROBERT I. KAUFMAN
Acting Chief, Engineering Division

1 Incl
as

CF w incl:
DAEN-ECE-B

Mr. Harrington - your copy / original to Tech

DEPARTMENT OF THE ARMY
LOWER MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
P. O. BOX 80
VICKSBURG, MISSISSIPPI 39180

REPLY TO
ATTENTION OF:

S: 31 May 85

LMVED

01 MAY '85

SUBJECT: Adjustments to NGS Bench Marks

Commander, New Orleans District
ATTN: LMNED-S

1. Our letter to you of 12 Apr 85, subject as above, inclosed a letter from John D. Bossler, Rear Admiral NOAA, concerning the 1983 Gulf Coast area adjustments to bench marks with several reports on elevation changes along the Gulf Coast.

2. From the material furnished we conclude that although regional subsidence is occurring in the Gulf Coast area, the amount of such subsidence cannot be determined accurately from available data, and it appears that a NOAA system called Grocadastre may be needed to obtain an accurate assessment of subsidence in the area.

3. In view of the potential significant consequences of elevation changes on projects in your District, we request that you reexamine the information in Rear Admiral Bossler's letter and then after any consultation with the NOAA staff which you consider necessary, propose a course of action for incorporating the changes in elevation into your projects and studies and for defining in a more reliable manner the subsidence of the area. Your action plan should include a schedule and cost estimate and is requested by 31 May 85.

FOR THE COMMANDER:

Robert I Kaufman

RT I. KAUFMAN, P.E.
ng Chief, Engineering Division

Mr Harrington - Ple note due date

28 May 85
504

LMNED-S (LMVED/1 May 85) 1st End Mr. Harrington/jes/2592
SUBJECT: Adjustments to NGS Bench Marks

DA, New Orleans District, Corps of Engineers, P.O. Box 60267, New Orleans, LA 70160-0267 24 May 1985

TO: Commander, Lower Mississippi Valley Division, ATTN: LMVED

1. Representatives of the NOAA met with the Regional Planning Commission representing Jefferson, Orleans, St. Bernard, and St. Tammany Parishes on 29 April 1985. These Parish governments have contributed funds to NOAA to rerun portions of the control net in their respective jurisdictions and further participation can be expected. Mr. Zilkoski of NOAA suggested that he present NOAA's estimate of overall needs to predict subsidence and to obtain a more reliable network to the New Orleans District. That meeting is now scheduled for 0900 on 12 June 1985 in the New Orleans District.

2. After the meeting with NOAA we will develop a recommended plan of action with a schedule and cost estimate.

FOR THE COMMANDER:

wd all encls

FREDERIC M. CHATRY
Chief, Engineering Division

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT CORPS OF ENGINEERS
P O BOX 60267
NEW ORLEANS LOUISIANA 70160

REPLY TO
ATTENTION OF
LMNED-S

7 August 1985

SUBJECT: NGS Benchmarks

Commander, Lower Mississippi Valley Division
ATTN: LMVED

1. Reference is made to the following:

a. LMNED letter dated 2 November 1984 to LMVD, subject supra.

b. LMVED letter dated 5 March 1985 to RA John D. Bossler, subject: Adjustments to NGS Benchmarks.

c. John D. Bossler letter to LMVD dated 29 March 1985 in response to reference b above.

d. LMVED-TS letter dated 12 April 1985 to LMNED-S subject: Adjustments to NGS Benchmarks.

e. LMVED letter dated 1 May 1985 to LMNED-S subject: Adjustments to NGS Benchmarks, and 1st End thereto.

2. In essence, it is the position of NGS as set forth in reference c above that the current (1983) benchmark elevations are correct, but that they cannot be used in conjunction with earlier values to derive estimates of subsidence which are necessarily valid even in order of magnitude. Thus we are left with a problem of setting project grades to provide the level of protection authorized. The problem is particularly acute on projects which are partially complete, in that, if we adopt the new benchmark elevations for construction without altering design flowlines, we ensure that those projects will provide inconsistent levels of protection; with the previously constructed portions offering lower levels of protection than those to be constructed in the future. At the same time, it would hardly be prudent, based on what we now know about benchmark elevations, to embark on a program of wholesale raising of previous construction to conform to the latest elevations. This is particularly true in situations in which design flowlines are primarily a function of discharge with tide level having little effect, and in tidal cases where increases in grade can only be achieved through demolition and reconstruction.

3. The problem extends as well to our stream gaging network since the gages which comprise that network are ordinarily adjusted to conform to the latest information published by NGS. As an example, consider the Carrollton gage, which is typical of gages at and below New Orleans. It has been raised about 0.6 foot since 1952 (1983 data have not yet been applied) with the result that the reading of the staff now corresponds to a reading 0.6 foot lower on the 1952 staff. Application of the 1983 data would result in raising the staff another half foot or a total increase of over 1 foot.

4. The problem is exacerbated by the information, recently received, that the 1983 data have been superseded by the results of releveling done in the New Orleans area at the request of local officials. New elevations for benchmarks in Jefferson, St. Bernard, Plaquemines, and Orleans Parishes have been published which, in most instances, represent significant upward revisions of the 1983 data. Additional results of the releveling are being processed and it seems reasonable to expect that they will reflect the same upward trends. The overall significance of these changes in the light of the repeated and ringing affirmations of confidence in the 1983 data which appear in NOAA's letter of 29 March 1985 is not easy to assess, but it does further weaken the case for imputing, with any reasonable confidence, hard physical significance to the changes in benchmark elevations. Yet the data promulgated by NOAA, given their presumed primacy in deciding where the earth's crust is in the vertical plane, cannot be ignored.

5. While the NGS program (cadastre) for evaluating subsidence may well produce data relevant to our problem (and for this reason alone, we would be well advised to support it) that program offers litle of utility in the foreseeable future. Thus we must select a course of action without material assistance from NGS.

6. Despite the absence of firm implications to be drawn from changing benchmark data, we believe that a clearly defined policy should be derived concerning the use of benchmark data in our various activities. Accordingly, we propose the following actions:

a. All gages will be set to conform to the latest available benchmark information published by NGS. Since both the gage information and the NGS data are widely disseminated, to do otherwise would be to court public confusion.

b. Modification of projects which have been completed will not be considered. The level of precision in the current data, and the practical difficulty and cost of changing such projects combine to mandate this course of action at least for the foreseeable future.

c. The main stem features of the MR&T project, such as MRL and Atchafalaya Basin, will be constructed utilizing the latest pre-1983 benchmark elevations. The grade requirements for these features are driven primarily by discharge and since subsidence presumably affects both bed and banks, required levee heights should be little affected by it. Thus, a shift to the new, lower benchmarks would result in the construction of levees higher than required to provide the authorized level of protection. There may be some problem with this approach at the lower (gulfward) ends of the system where tide becomes an increasingly important factor, and we plan to give that continuing consideration.

d. Off-main stem projects of the MR&T which are under construction or will be constructed in the future will use the latest benchmark data published by NGS at the time construction is/was started. The need for revision will be considered as construction proceeds.

e. All O&M dredging will use the latest available benchmark data published by NGS prior to the 1983 data. A change to the new data would mean that the depth of dredging in Southwest Pass, for example, would be lowered by about 1 foot. Given the perennial commotion by navigation interests, and considering the intensity of it this past year, such a course of action would be ill advised to say the least.

f. Hurricane protection projects which are partially complete will use the NGS benchmarks current at the time of construction of the first increment of the project. To shift to the later NGS data without altering the heights of previously constructed portions would make "fuseplugs" of those portions and thus impose a gratuitous servitude on the lands and facilities they protect. And altering previously constructed works would not be practicable.

g. New hurricane protection projects will be constructed using the latest available NGS benchmark data.

h. We plan to respond affirmatively to NOAA's invitation to participate in this "cadastre" program to better evaluate subsidence. Based on NOAA's estimates, the total costs would be $2.0 million in the first year, $525 thousand in the second year, and $345 thousand annually thereafter. Our participation would be in the form of membership on technical study groups and providing data. We do not, at this time, anticipate providing any direct funding.

7. Approval of the course of action set forth in paragraph 6 is recommended.

FOR THE COMMANDER:

Encls

FREDERIC M. CHATRY
Chief, Engineering Division

LMVED-TS (LMNED-S/7 Aug 85) 1st End Mr. Johnson/msm/5935
SUBJECT: NGS Benchmarks

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39180-0080

19 SEP '85

TO: Commander, New Orleans District, ATTN: LMNED-S

Your course of action outlined in para 6 of the basic letter is approved subject to the following comments:

a. Para 6b. We concur in general with this position; however, you should conscientiously review your flood control works and structures to ensure there are no exceptions that should be individually analyzed with an independent decision made on the specifics of that case.

b. Para 6c. While we agree in general with the rationale presented, the net result would be that there will be further disparity among levee grades, flowlines, and floodway operations. Therefore, the project design flowline of the Mississippi River and Tributaries Project should be adjusted within the affected areas to maintain comparability among the above elements.

c. Para 6f. Consideration should be given to reanalyzing and modifying (if needed) hurricane protection work in high density urban areas where the datum changes will drastically reduce the level of protection.

FOR THE COMMANDER:

William R. Hill for

FRED H. BAYLEY III
Chief, Engineering Division

5 Encls
nc

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

DAEN-CWH-D

21 March 1986

SUBJECT: Relative Sea Level Change

SEE DISTRIBUTION

1. The purpose of this letter is to provide the philosophy and distribute policy on the technical considerations required for relative sea level change in the design of coastal flood control and erosion protection projects.

2. Throughout geologic history, global sea level variations (both rise and fall) have occurred. Some authorities have found evidence to indicate we may be entering a new ice age with a resultant sea level drop. Others argue that increasing atmospheric concentrations of carbon dioxide and other gases are causing the earth to warm, thus contributing to a sea level rise. Global cooling or warming trends have at least two consequences: more extensive and rapid accumulation or melting of snow and ice in alpine and polar areas, and actual contraction or expansion of upper ocean waters. Both consequences contribute to "absolute" global sea level change. The absolute changes can not be distributed equally due to the dynamic and interactive nature of the earth's atmosphere, oceans, and crust and the changes required thereof by global cooling or warming.

3. Historic trends are commonly used in hydraulic and hydrologic studies to estimate expected future design conditions. Studies to determine expected precipitation intensities, water level frequencies, and shore erosion rates are typical examples. High confidence in the predicted values is generally limited to an average return period of not more than three times the length of data record. Local trends in local sea level change can perhaps best indicate what will occur in the future. The National Ocean Survey (NOS) has published sea level trends for regions along US Coasts based on yearly mean sea level records from its tide gages. These trends appear in the NOS publication entitled Sea Level Variations for the United States 1855-1980. Enclosure 1 is a table from this publication showing trends by region, from 1940 through 1980. Most existing tide gages are located on structures in harbors, and are responsive to land motions as well as water level changes.

DAEN-CWH-D 21 Mar 86
SUBJECT: Relative Sea Level Change

4. Predicting future sea level rise is risky because there are so many variables and, as yet undefined, interrelationships involved (see enclosure 2, Can Mean Sea Level Changes be Predicted?). It is for this reason that the hydraulic designers should not make projections of the degree of either global or relative sea level rise on other than a historic basis. Corps of Engineers policy is that, until substantial evidence indicates otherwise, we will maintain the procedure of considering only local regional history of sea level changes to project a rise or fall for a specific project.

5. While emergence or rebound of a land mass normally is not a problem along the coast, submergence or subsidence may often be a contributing factor in coastal flooding and erosion problems. Where long periods of tidal records exist and are used in determining the exceedance frequency relationship for coastal flood levels, it may be necessary to adjust the water level records for relative sea level changes when such changes are significant. Similarly, Coastal Engineering Technical Aid 79-2, A Method for Estimating Long-Term Erosion Rates from a Long-Term Rise in Water Level, May 1979, explains how to account for relative sea level rise in beach erosion estimates. Prudence may require an allowance in a project design for the continuation over the project design life of an established significant long-term trend in relative sea level rise. Consideration must be given to the relative magnitude of the suggested allowance and the confidence band of the data the designer is using and the tolerance allowed in constructing the project. For instance there would be no need for a sea level rise allowance of about one foot when the construction tolerance of the project structure is plus or minus one half foot. Another consideration is whether it is more cost effective to include the allowance for significant sea level rise in the initial construction or to plan for modification later after the need for such is demonstrated.

FOR THE COMMANDER:

for SB Powell

2 Encls
as

EARL E. EIKER
Acting Chief, Hydraulics and Hydrology Division
Directorate of Civil Works

Distribution:
(See page 3)

TABLE 6

TRENDS AND VARIABILITY*

AREA[a] AND U.S.[b] MEANS

1940 THROUGH 1980

| | | |
|---|---|---|
| **Northern East Coast** | | |
| Trend | 2.6 mm/yr | .009 ft/yr |
| Standard Error of Trend | ± .3 mm/yr | ±.0011 ft/yr |
| Variability[c] | ±24.5 mm | ±.080 ft |
| **Southern East Coast** | | |
| Trend | 1.9 mm/yr | .006 ft/yr |
| Standard Error of Trend | ± .4 mm/yr | ±.0013 ft/yr |
| Variability[c] | ±31.1 mm | ±.102 ft |
| **Gulf Coast** | | |
| Trend | 1.5 mm/yr | .005 ft/yr |
| Standard Error of Trend | ± .4 mm/yr | ±.0013 ft/yr |
| Variability[c] | ±29.5 mm | ±.097 ft |
| **Southern West Coast** | | |
| Trend | 1.0 mm/yr | .003 ft/yr |
| Standard Error of Trend | ± .4 mm/yr | ±.0012 ft/yr |
| Variability[c] | ±27.2 mm | ±.089 ft |
| **Northern West Coast** | | |
| Trend | - .4 mm/yr | -.001 ft/yr |
| Standard Error of Trend | ± .3 mm/yr | ±.0011 ft/yr |
| Variability[c] | ±25.9 mm | ±.085 ft |

[a] From area yearly mean sea level values rather than means of station trends, et cetera, in area.

[b] From means of area yearly mean sea level values rather than means of area trends, et cetera.

[c] Standard Error of Estimate.

* Variability is represented by the standard error of estimate, which is the standard deviation from the line of regression.

Attachment 1

Table 6, continued

| | | |
|---|---|---|
| United States | | |
| Trend | 1.3 mm/yr | .004 ft/yr |
| Standard Error of Trend | ± .2 mm/yr | ±.0007 ft/yr |
| Variability[c] | ±16.2 mm | ±.053 ft |

[c] Standard Error of Estimate.

DEPARTMENT OF THE ARMY
MISSISSIPPI RIVER COMMISSION, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI 39180

ADDRESS REPLY TO:

PRESIDENT, MISSISSIPPI RIVER COMMISSION
CORPS OF ENGINEERS
P. O. BOX 80
VICKSBURG, MISSISSIPPI 39180 -0080

MRCED-WH

01 APR 86

SUBJECT: Relative Sea Level Change

Commander, Vicksburg District, ATTN: LMKED-H
Commander, New Orleans District, ATTN: LMNED-H

The enclosed material is provided for your information.

FOR THE PRESIDENT OF THE COMMISSION:

Encl

Fred H. Bayley III

FRED H. BAYLEY III
Chief, Engineering Division

Mr. [illegible]

28 Aug 86

Our letter on the benchmarks was directed primarily toward construction. Dredging maintenance was also addressed.

But... no mention of operational changes.

My concern is how to adjust gage readings over time to compensate for changes.

Tom Harrington

Mr Harrington: I'd like a recommendation

GRAND ISLE

LMNED-S

Subject: NGS SURVEYS & PLOTS FOR H&H

2 Sep 86

TO: C/Design Br.
C/ H&H Br.

FROM: C/Des S

...ngton/2592

1. Recently Mr. C.J. Nettles informed Mr. Chatry about a decision by Operations Division to adjust the operation of East and West Calumet Floodgates by 0.3 feet because the gage had been adjusted by 0.3 feet for the "new" NGS datum. Mr. Chatry ask me for a copy of our correspondence to LMVD~~...~~ concerning NGS Benchmarks (copy enclosed) and Mr. Chatry has asked for a recommendation

The thrust is at least two fold:

a. What operational changes in structures is warrented? A question for Design Branch as Operational Manuals are prepared by that Branch.

b. How to adjust the multidunious gage readings collected over many years to compensate for benchmark changes that are documented at infrequent intervals and not always with physical point checks? A question for H&H Branch and Design Services initially and for a much larger body subsequently.

3. I will be meeting with you in the near future, to discuss the above and to develop recommendations.

Thomas E Harrington
C/Des Svs Br

CF: MR. JUDLIN
MR. SOILEAU
MR. ROMAN

→ Mr. Barton

MEMO TO MR. WAGAHOFF

1. As per your recent request, attached is a suggested rationale for inclusion of an extra foot of freeboard in the WBHP levees as an allowance for future change in apparent sea level.

2. I have found only one prior expression by us which speaks directly to this issue. It was in the Reevaluation Study for Lake Pontchartrain, La. & Vic. The attached rationale represents a reasonable extension of that expression.

FREDERIC M. CHATRY
3/4/87

CF: w/encl

Mr. Seale
Mr. Soileau
Mr. Picciola
Mr. Shelton
Mr. Harrington HS CF: Mr. Barton
Mr. Judlin

As is well documented over time, absolute sea level is not constant. The record includes periods of consistent rise or fall with contrary excursions sandwiched in. For the past 5,000 years, the trend has been consistently up. The current rate of rise in absolute sea level is thought to be less than 1.0 foot per century. A number of scenarios developed in the last few years project wildly accelerating rates of sea level rise due to the increased accumulations of carbon dioxide in the atmosphere. These scenarios are far too conjectural to influence project planning.

The impact of sea level rise on land areas is very much influenced by local conditions. Where the coastal land mass rises sharply as one moves landward from the shoreline, the impact is minimized, and where it does not, that impact is intensified. Furthermore, the vertical stability of the land mass involved is most important. Where subsidence is material, the impact of such subsidence frequently is far more important than the rise in absolute sea level. Insofar as those who live on the land mass are concerned, it makes no difference whether the sea goes up or the land goes down, for the impact is the same. Thus, planners in coastal areas must be more concerned with what is called the apparent rise in sea level than with the absolute rise.

The "stuff" of which Coastal Louisiana is largely comprised is the accumulated sediments brought down by the Mississippi. Depending upon location, it is more or less susceptible to various influences, all of which result in subsidence of the land mass over time. These include consolidation, compaction, downwarping of the coastal region under the load of sedimentation accumulation, faulting, and to some extent, extraction of groundwater and/or minerals. A localized phenomenon associated with forced drainage of developed areas can result in dramatic reductions in land elevations as the water is removed from highly organic surface soils, but this phenomenon is usually not particularly important insofar as levee grades are concerned.

Subsidence rates (excluding the aforementioned phenomenon) in some parts of the project area of as much as 2.0 - 2.5 feet per century have been observed while in others rates have been much lower. Unfortunately, the measurement of subsidence rates is not an exercise in precision, and the economic and environmental costs to build into levee projects allowances which would accommodate the larger values are so great as to preclude such allowances. There is, however, no doubt that subsidence is going on in the project area, and it represents another element of uncertainty with respect to the establishment of a levee freeboard to deal with the admittedly less than totally precise nature of our calculations. Currently, it is our practice to allow a freeboard of 2 feet above stillwater levels for levees not subject to waves, and 3 feet of freeboard above the stillwater level, or the limit of wave runup, whichever is the higher, where waves are a factor. An additional allowance of 1 foot for possible future changes in apparent sea level is believed to be prudent.

CECW-EP

**DEPARTMENT OF THE ARMY**
**U. S. Army Corps of Engineers**
**Washington, D.C. 20314-1000**

ETL 1110-2-349

Engineer Technical Letter
No. 1110-2-349

1 April 1993

# Engineering and Design
# REQUIREMENTS AND PROCEDURES FOR REFERENCING COASTAL NAVIGATION PROJECTS TO MEAN LOWER LOW WATER DATUM

## 1. Purpose.

This engineer technical letter (ETL) provides guidance, technical considerations, and general implementation procedures for referencing coastal navigation projects to a consistent Mean Lower Low Water (MLLW) datum based on tidal characteristics defined and published by the U.S. Department of Commerce. This guidance is necessary to implement applicable portions of Section 224 of the Water Resources Development Act of 1992.

## 2. Applicability.

This ETL applies to HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities (FOA) having responsibilities for design of river and harbor navigation projects on the Atlantic, Gulf, and Pacific coasts, and where such projects are subject to tidal influence.

## 3. References.

*a.* Rivers and Harbors Appropriation Act of 1915 (38 Stat. 1053; 33 U.S.C. 562).

*b.* Water Resources Development Act of 1992 (WRDA 92), Section 224, Channel Depths and Dimensions.

*c.* ER 1130-2-306, Navigation Lights, Aids to Navigation, Navigation Charts, and Related Data Policy, Practices and Procedures.

*d.* ER 1130-2-307, Dredging Policies and Practices.

*e.* EM 1110-2-1003, Hydrographic Surveying.

*f.* EM 1110-2-1414, Water Levels and Wave Heights for Coastal Engineering and Design.

*g.* Tidal Datum Planes, Special Publication 135, U.S. Department of Commerce.

*h.* Manual of Tide Observations, Publication 30-1, U.S. Department of Commerce.

*i.* Tide and Current Glossary, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*j.* Statement of Work for the Installation, Operation and Maintenance of Tide Stations, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*k.* User's Guide for the Installation of Bench Marks and Leveling Requirements for Water Level Stations, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

*l.* The National Tidal Datum Convention of 1980, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD.

## 4. Background.

*a.* Depths of USACE navigation projects in coastal areas subject to tidal influences are currently referred to a variety of vertical reference planes, or datums. Most project depths are referenced to a local or regional datum based on tidal phase criteria, such as Mean Low Water, Mean Lower Low Water, Mean Low Gulf, Gulf Coast Low Water Datum, etc. Some of these tidal reference planes were originally derived from U.S. Department of Commerce, National Ocean Service (NOS) observations and definitions used for the various coasts (see references 3g and 3i). Others were specifically developed for a local project and may be without reference to an established vertical network (e.g. National Geodetic Vertical Datum of 1929) or a tidal reference. Depending on the year of project authorization, tidal epoch, procedures, and the agency that established or connected to the reference datum, the current adequacy of the vertical reference may be uncertain, or in some cases, unknown. In some instances, project tidal reference grades may not have been updated since original construction. In addition, long-term physical effects may have significantly impacted presumed relationships to the NOS MLLW datum.

*b.* The National Tidal Datum Convention of 1980 (reference 31) established one uniform, continuous tidal datum for all marine waters of the United States, its territories, and Puerto Rico. This convention thereby lowered the reference plane (and tidal definition) of both the Atlantic and Gulf coasts from a mean low water datum to a MLLW datum. In addition, the National Tidal Datum Epoch was updated to the 1960-1978 period and mean higher/high water datums used for legal shoreline delineation were redefined.

*c.* Since 1989, nautical charts published by the Coast and Geodetic Survey (C&GS), U.S. Department of Commerce, reference depths (or soundings) to the local MLLW reference datum, also termed a "chart datum." U.S. Coast Guard (USCG) Notices to Mariners also refer depths or clearances over obstructions to MLLW. Depths and clearances reported on USACE project/channel condition surveys provided to C&GS, for incorporation into their published charts in plan or tabular format, must be on the same NOS MLLW reference as the local chart of the project site.

*d.* WRDA 92, Section 224, requires consistency between USACE project datums and C&GS marine charting datums. This act amended Section 5 of the Rivers and Harbors Appropriation Act of 1915 (reference 3a) to define project depths of operational projects as being measured relative to a MLLW reference datum for all coastal regions. (Only the Pacific coast was previously referenced to MLLW). The amendment states that this reference datum shall be as defined by the Department of Commerce for nautical charts (C&GS) and tidal prediction tables (NOS) for a given area. This provision requires USACE project reference grades be consistent with NOS MLLW.

## 5. Impact of MLLW Definition on USACE Projects.

*a.* Corps navigation projects that are referenced to older datums (e.g., Mean Low Water along the Atlantic coast or various Gulf coast low water reference planes) must be converted to and correlated with the local MLLW tidal reference established by the NOS. Changes in project grades due to redefining the datum from mean low water to NOS MLLW will normally be small, and in many cases will be compensated for by offsetting secular sea level or epochal increases occurring over the years. Thus, impacts on dredging due to the redefinition of the datum reference are expected to be small and offsetting in most cases.

*b.* All Corps project reference datums, including those currently believed to be on MLLW, must be checked to insure that they are properly referred to the latest tidal epoch, and that variations in secular sea level, local reference gage or benchmark subsidence/uplift, and other long-term physical phenomena are properly accounted for. In addition, projects should be reviewed to insure that tidal phase and range characteristics are properly modeled and corrected during dredging, surveying, and other marine construction activity, and that specified project clearances above grade properly compensate for any tidal range variances. Depending on the age and technical adequacy of the existing MLLW reference (relative to NOS MLLW), significant differences could be encountered. Such differences may dictate changes in channels currently maintained. Future NOS tidal epoch revisions will also change the project reference planes.

*c.* Conversion of project datum reference to NOS MLLW may or may not involve field tidal observations. In many projects, existing NOS tidal records can be used to perform the conversion, and short-term simultaneous tidal comparisons will not be required. Tidal observations and/or comparisons will be necessary for projects in areas not monitored by NOS or in cases where no recent or reliable observations are available (see references 3e and 3h).

## 6. Implementation Actions.

A number of options are available to USACE commands in assessing individual projects for consistency and accuracy of reference datums, and performing the necessary tidal observations and/or computations required to adequately define NOS MLLW project reference grade. Datum establishment or verification may be done using USACE technical personnel, through an outside Architect-Engineer contract, by another Corps district or laboratory having special expertise in tidal work, or through reimbursable agreement with NOS. Regardless of who performs the tidal study, all work should be closely coordinated with both the C&GS and NOS in the Department of Commerce.

*a.* *Technical Specifications.* The general techniques for evaluating, establishing, and/or transferring a tidal reference plane are fully described in the USACE and Department of Commerce publications referenced in paragraph 3. These references should be cited in technical specifications used for a tidal study contract or reimbursable agreement with another agency/command.

*b. Department of Commerce Contacts.* Before and during the course of any tidal study, close coordination is required with NOS. The NOS point of contact is the Chief, Ocean and Lake Levels Division, National Ocean Service (ATTN: N/OES2), 6001 Executive Blvd., Rockville, MD 20852, telephone (301) 443-8807, FAX (301) 443-1920.

*c. Sources.* If in-house forces are not used, the following outside sources may be utilized to perform a tidal study of a project, including any field tidal observations.

(1) Architect-Engineer (A-E) Contract. A number of private firms possess capabilities to perform this work. Either a fixed-scope contract or indefinite delivery type (IDT) contract form may be utilized. In some instances, this type of work may be within the scope of existing IDT contracts. Contact NOS to obtain a typical technical specification which may be used in developing a scope of work. The references in paragraph 3 of this letter must be cited in the technical scope of work for the A-E contract.

(2) Reimbursable Support Agreement. Tidal studies and datum determinations may be obtained directly from the NOS, Department of Commerce, via a reimbursable support agreement. A cooperative agreement can be configured to include any number of projects within a district. Funds are provided to NOS by standard inter-agency transfer methods and may be broken down to individual projects. Contact the Chief of the Ocean and Lake Levels Division at the address given in paragraph 6b to coordinate and schedule a study agreement.

*d. Scheduling of Conversions.* Section 224 of WRDA 92 did not specify an implementation schedule for converting existing projects to NOS MLLW (or verifying the adequacy of an existing MLLW datum). It is recommended that a tidal datum study be initiated during a project's next major maintenance cycle.

*e. Funding.* No centralized account has been established to cover the cost of converting projects to NOS MLLW datum. Project O&M funds will be used to cover the cost of tidal studies and/or conversions on existing projects. For new construction, adequate funding should be programmed during the initial planning and study phases. Budget estimates for performing the work can be obtained from NOS.

*f. MLLW Relationship to National Vertical Network.* Reference 3k prescribes requirements for connecting USACE tidal bench marks to the national vertical network maintained by C&GS; either the National Geodetic Vertical Datum, 1929 Adjustment (NGVD 29) or the updated North American Vertical Datum, 1988 Adjustment (NAVD 88). Project condition surveys, maps, reports, studies, etc. shall clearly depict the local relationship between MLLW datum and the national vertical network.

*g. Changes in Dredging.* It is not expected that the datum conversion will significantly impact dredging requirements. USACE commands should request HQUSACE guidance should a datum conversion cause a significant change in a channel's maintained depth.

**7. Proponency.**

The proponent for this technical letter is the Engineering Division, HQUSACE. Any comments regarding improvements and/or clarifications should be submitted to HQUSACE, ATTN: CECW-EP-S, 20 Massachusetts Ave., NW, Washington, D.C. 20314-1000.

FOR THE DIRECTOR OF CIVIL WORKS:

PAUL D. BARBER, P.E.
Chief, Engineering Division
Directorate of Civil Works

[Docket No. 930650-3150]

**Affirmation of Vertical Datum for Surveying and Mapping Activities**

**SUBAGENCY:** National Ocean Service, Coast & Geodetic Survey. National Oceanic and Atmospheric Administration, DOC

**ACTION:** Notice.

**SUMMARY:** This Notice announces a decision by the Federal Geodetic Control Subcommittee (FGCS) to affirm the North American Vertical Datum of 1988 (NAVD 88) as the official civilian vertical datum for surveying and mapping activities in the United States performed or financed by the Federal Government. and to the extent practicable, legally allowable, and feasible, require that all Federal agencies using or producing vertical height information undertake an orderly transition to NAVD 88.

**FOR FURTHER INFORMATION CONTACT.** Mr. James & Stem, N/CG1x4, SSMC3, Station 9357, National Geodetic Survey. NOAA, Silver Spring, Maryland 20910; telephone: 301-713-3230.

**SUPPLEMENTARY INFORMATION** The Coast and Geodetic Survey (C&GS), National Geodetic Survey (NGS), has completed the general adjustment portion of the NAVD 88 project, which includes approximately 80 percent of the previously published bench marks in the NGS data base. The remaining "posted" bench marks which comprise approximately 20 percent of the total will be published by October 1993. Regions of significant crustal motion will be analyzed and published as resources allow.

NAVD 88 supersedes the National Geodetic Vertical Datum of 1929 (NGVD 29) which was the former official height reference (vertical datum) for the United States. NAVD 88 provides a modem, improved vertical datum for the United States, Canada, and Mexico. The NAVD 88 heights are the result of a mathematical least squares general adjustment of the vertical control portion of the National Geodetic Reference System and include 80,000 km of now U.S. Leveling observations undertaken specifically for this project.

NAVD 88 height information in paper or digital form is available from the National Geodetic Information Branch, N/CG174, SSMC3, Station 9202, National Geodetic Survey. NOAA, Silver Spring, Maryland, 20910; telephone: 301-713-3242.

Dated: June 21, 1993.

**W. Stanley Wilson,**

*Assistant Administrator for Ocean Services and Coastal Zone Management, NOAA.*

[FR Doc. 93-14922 Filed 6-23--93; 8:45 am)

**BILLING CODE 351**

Federal Register / Vol. 58, No. 120 / Thursday. June 24, 1993 / Notices 34245
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Dated: June 21, 1993.
W. Stanley Wilson, Assistant Administrator for 0cean Services and Coastal Zone Management, NOAA.
[FR Doc. 93-14922 Filed 6-23--93; 8:45 am)
BILLING CODE 351

243-400C

# The Board of Commissioners

OF THE

# Orleans Levee District

SUITE 202 — ADMINISTRATION BUILDING
NEW ORLEANS LAKEFRONT AIRPORT

New Orleans, La.

70126

PROTECTING YOU
AND YOUR FAMILY

August 13, 1993

Mr. Eugene Tickner
Chief Engineering Division
U. S. Army Corps of Engineers
New Orleans District
P. O. Box 60267
New Orleans, La. 70160-0267

RE: London and Orleans Avenue Outfall Canals
Lake Pontchartrain & Vicinity Hurricane Protection

Mr. Tickner:

Enclosed are the description of benchmarks for Phase IID Orleans Avenue Canal, and Pumping Station No. 3 to Mirabeau London Avenue Canal projects. The Orleans Avenue Canal benchmark is based upon a 1983 datum and the London Avenue Canal benchmark is based upon a 1964 datum. Other contracts for work on these canals are based upon the same datums for each canal.

According to our records there is an adjustment required between these two datums. The adjustment required makes elevation of flood protection for the Orleans Canal higher than that for the London Canal. This appears to be an intolorable situation.

Please adjust as may be required so as to provide maximum protection for both canals.

Sincerely

for Stevan G. Spencer, P.E.
Chief Engineer

SGS:FPM:pns
Enclosure

H. B. Lansden
Geneva Grille, DOTD

**DEPARTMENT OF THE ARMY**
**U. S. Army Corps of Engineers**
**Washington, D.C. 20314-1000**



Technical Letter
No. 1110-1-152

1 January 1994

## Engineering and Design
## CONVERSION TO THE NORTH AMERICAN VERTICAL DATUM OF 1988

### 1. Purpose

This technical letter provides technical guidance and implementation procedures for the conversion from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88).

### 2. Applicability

This letter is applicable to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having responsibility for civil works, military construction, or environmental restoration projects.

### 3. References

*a.* Water Resources Development Act of 1992 (WRDA 92), Section 224, Channel Depths and Dimensions.

*b.* EM 1110-2-1003, Hydrographic Surveying.

*c.* Converting the National Flood Insurance Program to the North American Vertical Datum of 1988: Guidelines for Community Officials, Engineers, and Surveyors, FEMA Report No. FIA-20, June 1992.

*d.* Results of the General Adjustment of the North American Datum of 1988, American Congress on Surveying and Mapping Journal of Surveying and Land Information Systems, Vol. 52, No. 3, 1992, pp. 133-149.

*e.* American Congress on Surveying and Mapping Ad Hoc Committee Report on NAVD88, Special ACSM Report, 1990.

### 4. Discussion

*a.* NGVD29 has been replaced by NAVD88, an international datum adopted for use in Canada, the United States and Mexico. NAVD88 was established to resolve problems and discrepancies in NGVD29. The adjustment of NAVD88 was completed in June 1991 by the National Geodetic Survey (NGS), an agency of the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). NAVD88 was constrained by holding fixed the height of a single primary tidal benchmark (BM) at Father's Point/Rimouski, Québec, Canada, and performing a minimally constrained general adjustment of U.S.-Canadian-Mexican leveling observations. The result of this adjustment is newly published NAVD88 elevation values for benchmarks (BMs) in the NGS inventory. Most Third-Order BMs, including those of other Federal, state and local government agencies, were not included in the NAVD88 adjustment. Appendix A contains further background information on the development and adjustment of NAVD88.

*b.* The Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC) has affirmed that NAVD88 shall be the official vertical reference datum for the U.S. The FGDC has prescribed that all surveying and mapping activities performed or financed by the Federal Government make every effort to begin an orderly transition to NAVD88, where practicable and feasible.

*c.* Both tidal and non-tidal low water reference planes and datums are affected by the change to NAVD88. The datum for the Great Lakes is now the International Great Lakes Datum of 1985 (IGLD85). Unlike the prior datum (IGLD55), IGLD85 has been directly referenced to NAVD88 and originates at the same point as NAVD88. Elevations of reference points/datums along the various inland waterway systems will also be impacted by the change in datums.

*d.* The transition to NAVD88 may have considerable impact on Corps projects, including maps, drawings, and other spatial data products representing those projects. However, once completed, the transition will result in a more accurate vertical reference datum that has removed leveling errors, accounts for subsidence, and other changes in elevation.

*e.* A computer program entitled "VERTCON 1.0" can be used to make approximate conversions between NGVD29 and NAVD88. This program was developed by NGS and during the later part of FY94 will be incorporated into the USACE program CORPSCON. VERTCON conversions are intended for general small-scale mapping uses -- VERTCON should not be used for converting benchmark elevations used for site plan design or construction applications. Further details on VERTCON are at Appendix A.

## 5. Action

*a.* USACE commands should begin the orderly transition to NAVD88. Procedural guidance for performing this conversion is given in Appendix A.

*b.* The conversion to NAVD88 should be accomplished on a project by project basis. The relationship of all project datums to both NGVD29 and NAVD88 will be clearly noted on all drawings, charts, maps, and elevation data files.

*c.* In accordance with Section 24 of WRDA 92, when elevations are referred to a tidal reference plane in coastal waters of the U.S., Mean Lower Low Water (MLLW) shall be used as the vertical datum. Tidal BMs should be tied to NAVD88 instead of NGVD29 where NAVD88 data is available. Tidal datums shall be established in accordance with the procedures outlined in EM 1110-2-1003.

*d.* Other hydraulic-based reference planes established by USACE for the various inland waterways, reservoirs, and pools between control structures should continue to be used for consistency; however, they should also be connected with the NAVD88 where practicable and feasible.

*e.* In project areas where local municipal or sanitary jurisdictions have established their own vertical reference planes, every attempt should be made to obtain the relationship between that local datum and NGVD29 and/or NAVD88; and clearly note this relationship on all drawings, charts, maps, and elevation data files.

## 5. Technical Assistance

The U.S. Army Topographic Engineering Center (USATEC) may be consulted if technical assistance is required in the conversion effort. Contact Commander and Director, USATEC, ATTN: CETEC-TL-SP, Building 2592, Fort Belvoir, VA 22060-5546. The HQUSACE proponent for this action is the Engineering Division, Directorate of Civil Works, ATTN: CECW-EP-S.

FOR THE DIRECTOR OF CIVIL WORKS:

1 Appendix
APP A - Development and Implementation of NAVD88

PAUL D. BARBER
Chief, Engineering Division
Directorate of Civil Works

# APPENDIX A
# DEVELOPMENT AND IMPLEMENTATION OF NAVD88

## SECTION I
## Background

### 1. General

*a.* The NAVD88 is a new vertical datum for North America which effectively covers Canada, Mexico, and the U.S. The new adjustment of the U.S. National Vertical Control Network (NVCN) was authorized in 1978, and in 1982 the National Oceanic and Atmospheric Administration (NOAA) and Canada signed a Memorandum of Understanding (MOU) regarding the adoption of a common, international vertical control network called the NAVD88.

*b.* The Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC) has adopted the new NAVD88 datum. In addition, NAVD88 was established in conjunction with the International Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data. This committee defined the IGLD85 which was published for use in January 1992. IGLD85 replaced IGLD55.

### 2. The National Vertical Control Network (NVCN): NGVD29 and NAVD88

*a.* The NVCN consists of a hierarchy of interrelated nets which span the United States. Before the adoption of NAVD88, benchmark (BM) elevations of the NVCN were published as orthometric heights referenced to NGVD29. NGVD29 was established by the United States Coast and Geodetic Survey's (USC&GS's) 1929 General Adjustment. NGVD29 was established by constraining the combined U.S. and Canadian first order leveling nets to conform to Mean Sea Level (MSL) as determined at 26 long term tidal gage stations that were spaced along the east and west coast of North American and along the Gulf of Mexico, with 21 stations in the U.S. and 5 stations in Canada.

*b.* Local MSL is a vertical datum of reference that is based upon the observations from one or more tidal gaging stations. NGVD29 was based upon the assumption that local MSL at those 21 tidal stations in the U.S. and 5 tidal stations in Canada equalled 0.0000 foot on NGVD29. The value of MSL as measured over the Metonic cycle of 19 years shows that this assumption is not entirely valid and that MSL varies from station to station.

*c.* The NGVD29 was originally named the Mean Sea Level Datum of 1929. It was known at the time that because of the variation of ocean currents, prevailing winds, barometric pressures and other physical causes, the MSL determinations at the tide gages would not define a single equipotential surface. The name of the datum was changed from the Mean Sea Level Datum to the NGVD29 in 1973 to eliminate the reference to sea level in the title. This was a change in name only; the definition of the datum established in 1929 was not changed. Since NGVD29 was established, it has become obvious that the geoid based upon local mean tidal observations would change with each measurement cycle. Estimating the geoid based upon the constantly changing tides does not provide the most stable estimate of the shape of the geoid, or the basic shape of the Earth.

*d.* The datum for NAVD88 is based upon the mass or density of the Earth instead of the varying heights of the seas. Measurements in the acceleration of gravity are made at observation points in the network and only one datum point, at Pointe-au-Pere/Rimouski, Québec, Canada, is used. The vertical reference surface is therefore defined by the surface on which the gravity values are equal to the control point value. Although the international cooperation between the United States and Canada greatly strengthened the 1929 network, Canada did not adopt the 1929 vertical datum. The NGVD29 was strictly a national datum. NAVD88 is an international vertical datum for the US, Canada, and Mexico.

### 3. Distinction Between Orthometric and Dynamic Heights

*a.* There are several different reference elevation systems used by the surveying and mapping community. Two of these height systems are relevant to IGLD85: orthometric heights and dynamic heights. Geopotential numbers relate these two systems to each other. The geopotential number (C) of a BM is the difference in potential measured from the reference geopotential surface to the equipotential surface passing through the survey mark. In other words, it is the amount of work required to raise a unit mass of 1 kg against gravity through the orthometric height to the mark. Geopotential differences are differences in potential which indicate hydraulic head. The orthometric height of a mark is the distance from the reference surface to the mark, measured along the line perpendicular to every equipotential surface in between. A series of equipotential surfaces can be used to represent the gravity field. One of these surfaces is specified as the reference system from which orthometric heights are measured. These surfaces defined by the gravity field are not parallel surfaces because of the rotation of the earth and gravity anomalies in the gravity field. Two points, therefore, could have the same potential but may have two different orthometric heights. The value of orthometric height at a point depends on all the equipotential surfaces beneath that point.

*b.* The orthometric height (H) and the geopotential number (C) are related through the following equation:

$$C = G * H$$

where G is the gravity value estimated for a particular system. Height systems are called different names depending on the gravity value (G) selected. When G is computed using the Helmert height reduction formula that is used for NAVD88, the heights are called Helmert Orthometric Heights. When G is computed using the International Formula for Normal Gravity, the heights are called Normal Orthometric Heights. When G is equal to normal gravity at 45° latitude, the heights are called Normal Dynamic Heights. It should be noted that dynamic heights are just geopotential numbers scaled by a constant, using normal gravity at 45° latitude equal to 980.6199 gals. Therefore, dynamic heights are also an estimate of hydraulic head. In other words, two points that have the same geopotential number will have the same dynamic height.

*c.* IGLD55 is a normal dynamic height system which used a computed value of gravity based on the International Formula for Normal Gravity. Today, there is sufficient observed gravity data available to estimate "true" geopotential differences instead of "normal" geopotential differences. The "true" geopotential differences, which were used in developing IGLD85 and NAVD88, will more accurately estimate hydraulic head.

## 4. Problems with NGVD29 and Why a New Datum Needed to be Established

*a.* Approximately 625,000 km of leveling have been added to the National Geodetic Reference System (NGRS) since the 1929 adjustment. Each new line has been adjusted to the network. The new leveling data uncovered some problems in NGVD29. Through the years, the agreement between the new leveling and the network BM elevations slowly grew worse. An investigation of NGVD29 general adjustment results indicates that large residuals were distributed in some areas of the country during that adjustment. For example, the accumulated 1929 adjustment correction along a 3000 km east-west leveling route from Crookston, Minnesota, to Seattle, Washington is a delta of 89 centimeters (cm).

*b.* Inconsistencies in NGVD29 have increased over the years. This increase is a function of factors such as:

(1) Many BMs were affected by unknown vertical movement due to earthquake activity, postglacial rebound, and ground subsidence.

(2) Numerous BMs were disturbed or destroyed by highway maintenance, building, and other construction.

(3) New leveling became more accurate because of better instruments, procedures, and improved computations. It was decided in 1977 that the high accuracy achieved by the new leveling was being lost when forced to fit the 1929 network, and plans were made to begin developing a new national vertical network.

*c.* These inconsistencies have not always been apparent to the user since NGS has periodically readjusted large portions of the NVCN and spread these large residuals over large areas. Eventually, however, there would be a large number of areas in which surveyors would not be able to check their work using NGVD29. NAVD88 is specifically designed to remove the inconsistencies and distortions such as those found in the NGVD29. NGS has held off incorporating approximately 40,000 km of newer leveling data for these reasons. These data were incorporated into the NAVD88.

## 5. Selection of the Adjustment Method for NAVD88

*a.* The FGCS created a Vertical Subcommittee in 1989 to study the impact of the NAVD88 on the programs of member agencies and to recommend a datum definition. Several different datum definitions for

NAVD88 were studied by the subcommittee and the three options below were selected for final consideration:

(1) Fix the elevation or mean sea level at a single point.

(2) Fix mean sea level at four tide gages located at the network corners.

(3) Fix the NGVD29 elevations at 18 existing, well scattered BMs.

*b.* Two options were considered for the establishment of the vertical datum: (1) tidal epoch or (2) a minimally constrained adjustment. The tidal epoch option required that the adjustment hold MSL fixed at all appropriate primary tide stations and use the latest available tidal epoch. This definition is actually the same as NGVD29, but used the latest data available. The other option used a minimally constrained adjustment holding local MSL fixed at one primary tide station and adjusting all leveling data to it. This second option would maintain the integrity of the leveling data but would also create the greatest deviation from the presently published data.

*c.* Research was done by NGS to determine which option would be the best choice. To assist in the NAVD88 datum definition decision, several adjustments were performed using different constraints. The results obtained from several trial adjustments indicate that no matter which datum definition scenario is chosen for NAVD88, including a minimally constrained adjustment, that changes in absolute heights of as much as 75 to 100 cm would exist between NGVD29 and NAVD88.

*d.* In addition to the NGS research, agencies and appropriate bodies were queried to determine which option would be their preference and to ask for recommendations. The FGCS and the American Congress on Surveying and Mapping (ACSM) established committees to investigate the impact of NAVD88 on their members' activities and the activities of others in the community. Members of these committees were requested to provide documentation on the affects that the readjustment would have on their user populations and to include specific examples describing the real impact of a new vertical datum on their products. USACE was included in the questionnaire survey. The ACSM report is included as a reference to this document.

*e.* As a preliminary measure, both committees drafted recommendations for NAVD88 and specified that NGS should:

(1) Perform minimally-constrained least squares adjustment of the data for NAVD88.

(2) Shift the datum vertically to minimize recompilation of National Mapping Products.

(3) Develop computer transformation software to convert between NGVD29 and NAVD88. ("VERTCON").

(4) Develop national and/or regional geoid models to ensure GPS height differences meet at least 2nd Order, Class II FGCS precise geodetic leveling standards for accuracy.

*f.* Results indicated that the tidal epoch option would minimize the magnitude of the changes from NGVD29 to NAVD88 and thus possibly allow direct comparison of present hydrographic survey elevations with the proposed new NAVD88 elevations. The smaller change between elevations would cause less confusion and concern over flow heights, and the like. Regardless of the datum definition selected, large differences would exist between the NAVD88 and the NGVD29 heights. It should be noted that the NAVD88 heights are better estimates of orthometric heights than the NGVD29 heights. Better estimates of orthometric heights will become more critical in the future as surveying techniques continues to become more sophisticated and more accurate. The improved accuracy of geoid height determinations using GPS data requires the best estimate of true orthometric heights. Many cartographers want heights on their maps based on the best estimate of true orthometric heights.

## 6. The NAVD88 Adjustment

*a.* The NAVD88 adjustment is the culmination of over ten years of work. This effort has included: establishing about 100,000 km of trunk line leveling to reinforce weak areas in the network; modernizing the vast amount of leveling observation and description data that has been collected for over a century; performing adjustments of sections of the network to verify the quality of the observation data; informing the public users of the network of the pending change and determining the impact on the nation's engineering activities. After the datum definition was selected to be a minimally constrained adjustment, the final task of this effort was to perform the least squares adjustment of the whole network.

*b.* The general adjustment of NAVD88 was completed in June 1991. The primary network consists of 200 loops containing 909 junction BMs. The network connects to 57 primary tidal stations which are part of the National Primary Tidal Network and 55 international water-level stations along the Great Lakes. In addition, 28 border connections were made to the Canadian vertical control network and 13 to the Mexican vertical control network. Third order BMs of other agencies (e.g., USACE) were not included in this adjustment. The 500,000 BMs established by the USGS were also not placed in computer readable form and therefore will not have NAVD88 heights. In addition, USACE commands have established thousands of BMs which will not have NAVD88 heights.

*c.* A particular concern for the developers of the NAVD88 was how to resolve the many issues associated with the National Mapping Program (NMP) of USGS and the National Map Accuracy Standard (NMAS). The NMP includes more than 83,000 different map products of which over 7 million copies are distributed annually. Almost all of these products contain elevation information as contours and spot elevations on maps or as elevation arrays in Digital Elevation Models. Changing these products, both graphical and digital, to the NAVD88 will be a massive and costly undertaking and will require a decade or more to complete.

*d.* The new leveling data have additional corrections applied for refraction and rod correction and are adjusted in geopotential units rather than the orthometric system used in the past. The datum definition is the most scientifically acceptable of all the definitions considered and is the most natural because it is based on an undisturbed representation of the Earth's gravity field. It is the most suitable for the geoid height computations needed for the reduction of GPS ellipsoidal heights. The main disadvantage is the differences with MSL on the west coast. At Seattle, a person standing on the zero elevation contour (NAVD88) will barely have their head above water at midtide.

*e.* Preliminary analysis indicates that the overall differences between orthometric heights referred to NAVD88 and to the NGVD29 range from approximately -40cm to +150cm. Most surveying applications should not be significantly affected because the changes in relative height between adjacent BMs in most geotechnically stable areas should be less than 1 cm. In many geotechnically stable areas, a single bias factor describing the difference between NGVD29 and NAVD88 can be estimated and used for most mapping applications. This was a significant consideration for assessing the impact on the National Mapping Products. The absolute height values will change much more, but this should not be the surveyor's biggest concern, since he/she should be concerned with ensuring that all height values of BMs are referenced to the same vertical datum. The overall differences between dynamic heights referred to the IGLD85 and to IGLD55 will range from approximately 1 to 40 cm.

## 7. Maintenance of Parallel Datums by NGS: NAVD88 and NGVD29

For a period of time, NGS will support both the NAVD88 and the NGVD29. Beyond the next 5-7 years, continued maintenance of NGVD29 will depend on user demands and budget constraints.

## SECTION II
## Impact of NAVD88 Conversion on Other Hydraulic Reference Datums

### 8. International Great Lakes Datum of 1955 (IGLD55)

*a.* IGLD55 is a datum common to the United States and Canada and is defined by international agreement. Before the establishment and adoption of the IGLD55, the differences in elevation between the lakes had been determined but had not been connected to sea level and lake level data published from the United States and Canada did not match for the same lakes and rivers. The IGLD55 was an international cooperative effort between the those two countries, the result of which was that the Great Lakes-St. Lawrence River system was then covered by a single uniform vertical control network. The IGLD55 is different and separate from the NGVD29.

*b.* IGLD55 is by definition a hydraulic (i.e., dynamic) datum. The reference zero for IGLD55 is based on mean water level surface at Father's Point (Pointe-au-Pere), Québec, Canada. Holding this point fixed determined the IGLD55 datum. A procedure termed a "water level transfer" has been used to establish a local vertical datum on each of the Great Lakes. Research has concluded that the water level transfer technique was concluded to be at least as accurate as First-Order, Class I geodetic leveling. The remaining lakes were incorporated using a combination of level lines and water level transfers. Adjusted elevations on the IGLD55 are referenced using the dynamic number system. The dynamic value of a benchmark (BM) is not a true linear elevation, but a serial number given to the level surface on which the mark lies. Dynamic elevations were adopted for the IGLD55 primarily because they provide a means by which the geopotential hydraulic head can be measured more accurately between two points.

*c.* The earth's crust experiences movements around the entire Great Lakes and St. Lawrence River area. Therefore, the vertical reference datum for this area must be vertically readjusted every 25 to 30 years. This crustal movement is called "isostatic rebound," which is the gradual rising of the earth rebounding from the weight of the glaciers during the last glacial age. When IGLD55 was created, it was known that readjustment would be necessary due to the effects of isostatic rebound. Crustal movement is not uniform across the Great Lakes basin and causes bench marks to shift not only with respect to each other, but also with respect to the initial reference point. Subsidence and other local effects can cause bench marks to shift as well.

### 9. International Great Lakes Datum of 1985 (IGLD85)

*a.* The Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data revised the IGLD55 datum and established IGLD85. This committee has input to the international management of the Great Lakes-St. Lawrence River system. Representatives from the U.S. and Canada are members on this committee. The efforts of the Coordinating Committee to revise IGLD55 and establish IGLD85 were coordinated with the efforts to establish the new common international vertical datum for the US, Canada and Mexico, NAVD88.

*b.* The IGLD85 is the current vertical control reference system in the Great Lakes Basin. The IGLD55 was the vertical control reference system for this area until the publication of the IGLD85 in January, 1992. Originally, an IGLD 80 had been planned, but the project was extended. The epoch that was actually used to determine the mean water level for the new datum was from 1983-1988 of which the mean year is 1985. The reference zero point for IGLD85 is located at benchmark #1250G, located at Rimouski, Québec. This benchmark has an IGLD85 elevation of 6.723 meters and IGLD55 elevation of 6.263 meters. IGLD85 increases the number and accuracy of benchmarks in the Great Lakes area. Corps districts were targeted to have converted over to IGLD85 by January of 1993. This cannot be practically done until NOAA publishes complete IGLD85 BM data for the area. IGLD85 data is available for the gages, but the spacing of the gages is not dense enough to support conversion of local project control.

*c.* Agencies in the U.S. and Canada will use IGLD85. The National Oceanic Service (NOS) and the Canadian Hydrographic Service (CHS) began reporting water levels referenced to IGLD85 upon its implementation in January, 1992. For a period of time, conversion factors for both IGLD55 and IGLD85 water level data will be provided by NOAA/NOS Great Lakes Section and CHS. The monthly water level bulletins published by USACE and CHS will reflect this information.

*d.* IGLD85 will not change water levels established for federal flood insurance programs in the US. These levels will be referred to NAVD88. Elevations common to both NAVD88 and IGLD85 are available from NOAA. Lake-level outflows also will not be affected by the datum change to IGLD85. As benchmark information becomes available, navigation, construction, and other improvement work on the Great Lakes should be referred to IGLD85. Either datum is acceptable until the benchmark data is available for the respective USACE District or project area. Drawings shall include a note for the vertical IGLD datum in use to avoid blunders. USACE permit applications will still be referenced to the Ordinary High Water Mark (OHWM) as defined under Section 10 of the Rivers and Harbors Act. As benchmark information becomes available, new applications should reference IGLD85.

## 10. NAVD88 and IGLD85

*a.* The specific needs of the Great Lakes system were taken into account while the decision were being made about how NAVD88 was to be established. Analyses of data in the Great Lakes Basin was used to determine the effects of the datum constraint, magnitudes of height changes from the IGLD55, deficiencies in the network design, selection of water-level station pairs to be used to generate zero geopotential difference observations, and additional releveling requirements. This coordination provided a check on the accuracy of the work and established a conversion between the IGLD85 and NAVD88.

*b.* Elevations referenced to NGVD29 are unacceptable for use in resolving the involved problems of the Great Lakes System. The reference zero for NGVD29 is not located within the Great Lakes system and orthometric elevations are not sufficient for use with large bodies of water such as the Great Lakes. The dynamics of large bodies of water are not modelled well by considering them as single equipotential surfaces. Other forces such as gravity must be considered. For example, water level measurements obtained at both ends of the Lake and connected to the NGVD29 would show some magnitude of a permanently northerly slope.

*c.* The general adjustment of the NAVD88 and IGLD85 is one and the same. A minimum constraint adjustment of Canadian-Mexican-U.S. leveling observations was performed holding fixed the height of the primary tidal BM, referred to the new IGLD85 local mean sea level height value, at Father's Point/Rimouski, Québec, Canada. This constraint satisfies the requirements of shifting the datum vertically to minimize the impact of NAVD88 on USGS mapping products, as well as provides the datum point desired by the IGLD Coordinating Committee for IGLD85. The only difference between IGLD85 and NAVD88 is that IGLD85 BM values are given in dynamic height units and NAVD88 values are given in Helmert orthometric height units. The geopotential numbers of BMs are the same in both systems.

*d.* Geopotential numbers from the general adjustment of NAVD88 were used to compute IGLD85 dynamic heights. They will provide the best estimate of hydraulic head. If secondary gage data are placed in computer readable form, they will also be incorporated into NAVD88 and IGLD85. NGS will publish NAVD88 heights and provide, upon special request, geopotential numbers for all BMs included in NAVD88.

*e.* The use of GPS data and a high-resolution geoid model to estimate accurate GPS-derived orthometric heights will be a continuing part of the implementation of NAVD88 and IGLD85. It is important that users initiate a project to convert their products to NAVD88 and IGLD85. The conversion process is not a difficult task, but will require time and resources. Other local reference planes have been established by local jurisdictions and these can be referenced to either IGLD85 or NAVD88.

## 11. 1974 Low Water Reference Plane (LWRP)

*a.* On the Mississippi River between the mouths of the Missouri and the Ohio Rivers (the Middle Mississippi River), depths and improvements are referenced to a LWRP. No specific LWRP year is used for the Middle Mississippi north of Cairo, IL. Below Cairo, IL, depths and improvements along the Lower Mississippi River are referenced to the 1974 LWRP. This is also a hydraulic reference plane, established from long term observations of the river's stage, discharge rates, and flow duration periods. The low water profile was developed about the 97-percent flow duration line. The elevation of the 1974 LWRP drops gradually throughout the course of the Mississippi, however, some anomalies in the profile are present in places (particularly in areas containing rock bottoms or groins/weirs). The gradient is approximately 0.5 feet per river mile. The ever-changing river bottom will influence the 1974 LWRP. Changes in the stage-discharge relationship will influence the theoretical flow line for the 1974 LWRP.

*b.* Construction and improvements along the lower river are performed relative to the 1974 LWRP at a particular point. Differences in 1974 LWRP elevations between successive points along the river are determined from simultaneous staff readings and are referenced to benchmarks along the bank. The 1974 LWRP slope gradients between any two points must be corrected by linear interpolation of the profile. Thus, over a typical 1-mile section of river with a 0.5-foot gradient, each 1000-foot C/C river cross section will have a different 1974 LWRP correction, each dropping successively at approximately 0.1-foot increments.

*c.* Where practicable and feasible, NAVD88 should be used as the common reference plane from which 1974 LWRP elevations are measured. The relationship of all project datums to both NGVD29 and NAVD88 should be clearly noted on all drawings, charts, maps, and elevation data files. All initial surveys should be referenced to both NAVD88 and NGVD29. If this is not feasible, then NGVD29 should be used as the common reference plane from which 1974 LWRP elevations are measured until the move to NAVD88 can be accomplished. Differences between the 1974 LWRP and NGVD29 are published for the reference benchmarks used to control surveys and construction activities. In some districts, surveys are performed directly on NGVD29 without regard to the 1974 LWRP profile (i.e., elevations above NGVD29 are plotted rather than depths below 1974 LWRP). The 1974 LWRP depths are then contoured from the plotted NGVD29 elevations, with the 1974 LWRP profile gradients applied during the contouring process. If a survey is conducted over a given reach of the river, the 1974 LWRP-NAVD88 and/or the 1974 LWRP-NGVD29 conversion must be interpolated based on the slope profile over that reach.

*d.* Controlled portions of the Upper Mississippi are referred to pool levels between the controlling structures. Although a variety of reference datums are used on other controlled river systems or impoundment reservoirs, most are hydraulically based and relate to some statistical pool level (e.g., "normal pool level," "flat pool level," "minimum regulated pool level ", etc.).

*e.* On the Mississippi River above Melvin Price Locks and Dam at Alton, IL, to Lock and Dam No. 22 at Saverton, MO, the reference used is related to the minimum regulated pool elevation. These pools are regulated referenced to a "hinge point". The pools are drawn down when the river's flow will provide adequate navigation depths naturally. When the flows are reduced to low volumes, the pools are reestablished and are essentially level. The depths and improvements along this reach of the Mississippi River are referenced to the "minimum regulated pool" elevations.

*f.* On the Mississippi River above Lock and Dam No. 22 at Saverton, MO, to St. Paul, MN, a "flat pool level" reference is used, and soundings are shown as "depth below flat pool". The flat pool is the authorized elevation of the navigation project and can be referenced to any number of local datums. Most commonly, this level is referenced to the mean sea level (MSL) datum of 1912, the general adjustment which preceded 1929. Conversions between MSL 1912 and NGVD29 are available. The Illinois Waterway pool elevations are referred to NGVD29, however, relationships to numerous other datums are also made.

*g.* Vertical clearances (bridges, transmission lines, etc.) are usually measured relative to high and low waters of record, or relative to full pool elevations. Shore lines shown on river drawings and navigation maps may be referenced to a low water datum (i.e., 1974 LWRP). On the Mississippi River above Lock and Dam No. 22 at Saverton, MO, the plotted shore line is referenced to full pool stage at dams with discharges equaled or exceeded 90 percent of the time. Given the variety of reference levels, special care must be taken to properly identify the nature and source of all vertical reference datums used on a project. The datum notes should include and clearly depict the relationship to NAVD88.

# SECTION III
# Impact of NAVD88 Conversion on U.S. Geological Survey and Federal Emergency Management Agency Programs

## 12. NAVD88 and the National Mapping Program (NMP)

*a.* The NMP of the U.S. Geological Survey (USGS) includes more than 83,000 different map products. Some 55,000 of these are in the 7.5-minute, 1:24,000-scale, primary quadrangle map series (7.5-minute quads). These maps are widely used by Corps planners. Since the 7.5-minute quad series is the largest scale in the NMP and contains the greatest detail and elevation accuracy, it will be significantly affected by the vertical datum change.

*b.* The contour intervals of the 7.5-minute map series are selected to best express the topography of the area. With a few exceptions, the contour intervals range from 5 feet for very flat country to 80 feet for rugged mountainous terrain. In between these limits are 10-, 20-, and 40-foot contour intervals. A few maps in recent years have been compiled with metric value contours. The USGS production processes were designed to produce maps that meet the requirements of the National Map Accuracy Standards (NMAS). This standard requires that the error in 90% of the test points be less than one-half contour interval. Field survey methods are generally used to test the maps, and the elevation on the map is determined by interpolation between contours.

*c.* Other forms of vertical information shown on the USGS 7.5-minute maps are BMs and useful elevations, which are indicated by a cross symbol with the elevation given to the nearest foot. These elevations are established by geodetic leveling of third-order accuracy or better. Spot elevations are measured by field or photogrammetric methods are readily identifiable features, eg: natural lakes, definite tops and saddles, fence corners, or road intersections. These elevations are usually placed at a density of about one-per-square mile and are considered to be accurate to within three-tenths of the contour interval.

*d.* Digital files of topographic information will also be affected by a change in the vertical datum. A Digital Elevation Model (DEM) consists of a sampled array of elevations for ground positions that are usually at regularly spaced intervals. For the 7.5-minute DEM, the horizontal framework is the Universal Transverse Mercator (UTM) system and the spacing is 30 meters. The 1-degree DEM horizontal coordinate system is based on the latitude and longitude positions of the World Geodetic System of 1972 (WGS 72) datum and the spacing is 3 arc-seconds. Another form of the digital topographic data that will be affected by the datum conversion is the hypsography category Digital Line Graphs (DLG).

*e.* In support of the production of the USGS topographic maps, a 3rd order level network was established that resulted in few places being more than 5 miles from basic vertical control. These lines were usually established along farm roads, railroads, desert track roads, and mountain trails (less dense in mountain areas). USGS field surveyors have established nearly 500,000 BMs. Most of this work is on NGVD29.

*f.* Changing the above NMP products, both graphic and digital, to the NAVD88 will be a massive and costly undertaking and will require a decade or more to complete.

(1) In areas where the datum change is very small compared with the contour interval, advantage can be taken of the tolerance in the NMAS (i.e., 90% of the test point errors are less than ½ of the contour interval). If the datum change is only 1/10th of the contour interval, then the existing contours will still meet NMAS and will not require recompilation. The labeled elevations for BMs and spot elevations will need to be changed. This type of conversion is a low-cost approach but might be useful to extend the life of an otherwise sound map series. This is not a technically correct solution because a small bias is being introduced. Special care must be taken to insure that the contouring is in agreement with changed labeled elevations.

(2) Recompiling the contours and spot elevations on a 7.5-minute quad map is the most geometrically correct method of fitting the new vertical datum; however, this is an expensive approach. Therefore, total recompilation and recontouring due to an out-of-date datum is not considered to be cost-effective. However, some other factors may justify recompilation:

- Change to metric contours
- Terrain changes because of subsidence or other

causes

- Inaccurate existing contours or inappropriate contour interval

*g.* Adjusting the USGS 3rd-order leveling network to the NAVD88 is a different challenge, because high accuracy is needed to maintain its usefulness as geodetic data. This level of accuracy can only be provided by a least squares adjustment of the old observations to the new NAVD88 primary network elevations.

*h.* The selected NAVD88 datum definition best fits the needs of the NMP. The important characteristics are:

- Small elevation changes for the eastern half of the USA where the 7.5 map contour intervals are the smallest and large changes for the western half where contour intervals are the largest.

- The isograms representing these changes are smoother and show less irregularities.

Both of these are important if the map patching conversion techniques is to be used. The requirements are that the shift values be small compared with the contour interval and the gradient in the datum change be minimal so that a single change value can be applied over an entire 7.5-minute map with little noticeable error. A vertical shift (bias) in the defining elevation is desirable to expand the favorable interval/elevation change area over the entire U.S.

## 13. National Flood Insurance Program (NFIP) Transition to NAVD88

*a.* The NFIP is a federal program that provides identification of flood hazard areas on a community basis and includes availability of insurance against flood damages. When a community joins the NFIP, it agrees to adopt minimum Federal floodplain management criteria enforced by local regulations. The major product of the NFIP is the Flood Insurance Study (FIS) and accompanying Flood Insurance Rate Map (FIRM), which describes a community's floodplains and regulatory floodways, as well as computed flood profiles. FEMA prepares an FIS for severely flood prone communities, that identifies 100-year base flood elevations (BFEs) and flood hazard areas. Nearly all flood maps for these areas are referenced to the NGVD29. Conversion to NAVD88 will require the education of map users as well as map producers. New FISs will be based on NAVD88. Existing studies and maps will be converted when substantive revisions occur to redefine flood hazards.

*b.* The dual mission of the NFIP through the Federal Insurance Administration (FIA) is to reduce future flood losses as well as provide insurance coverage to offset deficit producing disaster assistance payments. To provide the floodplain management information to the communities, FEMA provides flood hazard mapping of major flooding sources within a community, usually based on the 100 year BFEs.

*c.* FEMA will be converting its products the NAVD88 in a gradual process primarily as FEMA's FISs and FIRMs are republished. Currently, the vast majority of FEMA products for the NFIP are referred to NGVD29. All FEMA studies contracted for FY93 and beyond will require the use of NAVD88 as vertical control. Since October 1992, all requests for map change actions received required the inclusion of NAVD88 data. The NFIP will transition to NAVD88 on a project basis or as other reasons for revision indicate.

## 14. Effects of NAVD88 on FIRMs and Communities

*a.* The base 100-year BFEs and Elevation Reference Marks (ERMs) will be converted to NAVD88. Use of the current datum will be acceptable until the change is made of the FIRM. After that time, all flood insurance policy sales and renewals will be based on elevations referenced to NAVD88. Determination of locations of structures and proposed projects with respect to special flood hazard areas (SFHAs) will be based upon elevations referenced to NAVD88. The datum listed as the reference datum on the applicable FIRM panel should be used for Elevation Certificate completion. This is FEMA policy for all NFIP communities since the NAVD88 is defined over all these regions. For Hawaii, the Pacific Trust Territories, the Commonwealth of Puerto Rico and the US Virgin Islands, their datums will be adjusted based upon releveling work done in those areas and their 1960-78 tidal epoch. Their local datums will be designated as NAVD88 and will be defined by their current local MSL determinations.

*b.* The conversion of the vertical reference datum from NGVD29 to NAVD88 will take place over time and documentation should be carefully maintained to reflect which vertical reference datum was used. If a FIS is completed with ERMs referenced to NAVD88, the conversion method and results shall be part of the deliverable items with that FIS. The FEMA Project Officer should be consulted to decide if NAVD88 must be used or not, prior to commencement of any work for that FIS.

*c.* No requirement is made by FEMA on local communities to relevel their local vertical control networks for NFIP purposes. If, however, the community's current vertical control system is referenced to an NGS bench mark(s) that is included in the new data available from NGS, then appropriate conversion can be made. Questions regarding the mechanics of shifting to NAVD88 may be addressed to the appropriate FEMA Regional Offices.

*d.* A very important potential problem is caused by mixing datums. If a consistent datum is used for determining Base 100-year BFEs and lowest floor elevation, actuarial rating and building requirements would be correctly determined. If mixed datums are used, significant problems arise. For example, if the 1-foot NAVD88 BFE is used mixed with the 2-foot NGVD29 lowest floor elevation, an error of 2 feet (not in the NFIP's favor) would occur. There are roughly 22 million people living in the nation's floodplains. Proposed elevations above the BFE are sometimes minimal for economic considerations, so up-to-date and properly referenced elevation data are a must. Correct referencing of those floodplains to the nation's vertical datum must be accomplished as soon as it is administratively and financially possible to do so.

## 15. Map Revision Requests to FEMA

*a.* As the NFIP moves further into the maintenance stage of the mapping program, the major action with respect to mapping of flood hazards will be the review and processing of requests for revisions to the currently effective FISs and FIRMs. The decision of whether to convert to NAVD88 as the reference datum for a revision action must be made on a case by case basis. All map revision requests should contain documentation of vertical control used and those requests to FEMA after 1 October 1992 must include vertical control data referenced to NAVD88. The decision regarding the published reference for the map revision will be made by the FEMA Project Officer for the applicable region.

*b.* Map revision requests shall include either NGS BM data or the method and computations used to tie to NGS BMs. If NGS BM data is unavailable, documentation to that effect must be submitted with the map revision request. If a computer program was used, the name of the program should be included along with where an exact copy of that program can be obtained. The leveling field notes should also be included. All surveying data must be certified by a licensed Land Surveyor or registered Professional Engineer. For all map revisions, the datum referenced on the current FIRM shall be used unless otherwise directed by the Project Officer. When the current map datum is used, a conversion factor to allow comparison to NAVD88 elevation should be included.

## 16. Impact of NAVD88 Change on Flooding Sources

*a. Riverine and Lacustrine Flooding.* For most areas affected by this type of flooding, the changes from NGVD29 to NAVD88 will be adequately addressed by a shift factor for areas of USGS 7.5-minute quadrangle series topographic maps. In larger areas than that, such as county wide studies involving significant stream or river reaches, additional considerations are necessary.

*b. Coastal Flooding.* In areas affected by coastal flooding, additional care must be taken to avoid confusion with local MSL data that are used in addition to NGVD29 data. In many areas, these are assumed to be the same, while in other areas differences may exist based upon the latest tidal observations. NGS has included in its published data the new reference elevations for tidal stations previously taken as 0.0000 foot on NGVD29. All vertical data must clearly reflect what basis of vertical control was used. For example, if mean low water datum was used, conversion to NAVD88, or at a minimum NGVD29, must be provided and sealed by a certified land surveyor.

*c. Other Influences.* Areas that have experienced crustal motion or land subsidence since the publication of the vertical control data for that area, must be referenced to at least one BM known to be stable. Documentation from a certified land surveyor or by the agency that recently releveled the BM must be included with any data submitted to FEMA. NGS will be publishing special reports for these areas as part of its ongoing long term task.

(1) For areas that experience uniform change over a given range, and where datum difference can be expressed as a bias factor for specific geographic areas, little

if any distortion will occur in the hydrologic and hydraulic parameters that influence the definition of a given floodplain. In these instances, FEMA will be concerned with assuring that the proper conversion of ground and hydraulic elevations takes place.

(2) In instances where non-uniform elevation differences are indicated, an investigation of the potential effect on hydraulic behavior will be required. Usually, unless the change in flood elevation or depth is greater than 0.5 foot or in some cases 1.0 foot, no republication of the flood elevations is dictated. Indications of potential changes of 1.0 foot or more will probably place the stream or community on the priority list for a contracted restudy to establish the exact effect of the changes.

**17. FEMA Policy for Map Conversion: Affect on NFIP Products**

FEMA datum conversion activities called for all FY93 FIS's to be referenced to NAVD88 and that this action be confirmed by the contractor with the Project Officer prior to the beginning of survey work. The study contractor is responsible for assuring that proper reference to NAVD88 is made.

**18. NAVD88 Requirements for Flood Insurance Studies**

*a. Type 15 Studies.* For initial studies, NAVD88 shall be required. Exceptions must be approved by the Project Officer prior to the start of survey work.

*b. Type 19 Studies and Limited Map Maintenance Program Studies.* Use of NAVD88 shall be the decision of the Project Officer. If NGVD29 is used, then a conversion factor to NAVD88 should be included with the study material.

*c.* The use of NAVD88 for these studies will be determined by the extent of the changes that will occur to the community's FIRM when revised. For communities whose FIRM is larger than 1 panel and revision of other panels is unlikely with the restudy, the use of NGVD29 may be continued, but a note explaining the conversion to NAVD88 should be included in the "NOTES" in the map border of the panel being revised.

# SECTION IV
# Corps of Engineers Transition Plan to NAVD88

## 19. General

A change in vertical datum will affect most USACE engineering, construction, planning, and surveying activities. The cost of conversion could be substantial at the onset. There is a potential for errors in conversions inadvertently occurring. The effects of the vertical datum change can be minimized if the change is gradually applied over time; being applied to future projects and efforts, rather than concentrated on changing already published products. In order to insure an orderly and timely transition to NAVD88 is achieved for the appropriate products, the following general guidelines in this section should be followed.

*a. Conversion Criteria.* Maps, engineering site drawings, documents and associated spatial data products containing elevation data may require conversion to NAVD88. Specific requirements for conversion will, in large part, be based on local usage -- that of the local sponsor, installation, etc. Where applicable and appropriate, this conversion should be recommended to local interests.

*b. Newly Authorized Construction Projects.* Generally, initial surveys of newly authorized projects should be referenced to NAVD88. In addition to design/construction, this would include wide-area master plan mapping work. The project control should be referenced to NAVD88 using conventional or GPS surveying techniques. All planning and design activities should be based upon NAVD88. All maps and site drawings shall contain datum notes as described below. If the sponsor/installation requires the use of NGVD29 or some other local vertical reference datum for continuity, the relationship between NGVD29 and NAVD88 shall be clearly noted on all maps, engineering site drawings, documents and associated products.

*c. Active Projects.* On active projects where maps, site drawings, or elevation data are provided to non-USACE users, the conversion to NAVD88 should be performed. This conversion to NAVD88 may be performed the next time the project is surveyed or when the maps/site drawings are updated for other reasons. Civil works projects may be converted to NAVD88 during the next maintenance or repair cycle in the same manner as for newly initiated civil works projects. However, if resources are not available for this level of effort, either re-draw the maps or drawings and add the necessary datum note. Plans should be made for the full conversion during a later maintenance or repair cycle when resources can be made available. MCA, OMA, AFH, OMAR, MCAF, OMAF and master planning projects should remain on NGVD29 or the local vertical datum until a thoroughly coordinated effort can be arranged with the MACOM DCSENGR and installation DEH, or AFRCE and BCE. An entire installation's control network should be transformed simultaneously to avoid different datums on the same installation. MACOMs should be encouraged to convert to NAVD88. However, the respective MACOMs are responsible for this decision.

*d. Inactive Projects.* For inactive projects or active projects where maps, site drawings or elevation data are not normally provided to non-USACE users, conversion to NAVD88 is optional.

*e. Work for Others.* Projects for other agencies will remain on NGVD29 or the current local vertical datum until a thoroughly coordinated effort can be arranged with the sponsoring agency. Other agencies should be encouraged to convert their projects to NAVD88, although the decision to convert rests with the sponsoring agency. However, surveys, maps and drawings should have the datum note described below added before distribution to non-USACE users. If sponsoring agencies do not indicate a preference for new projects, NAVD88 should be used.

*f. Miscellaneous Projects.* Other projects referenced to strictly local datum, such as structural deformation, beach nourishment, submerged offshore disposal areas, historical preservation projects, etc., need not necessarily be converted to NAVD88. However, it is recommended that surveys, maps and drawings have a clear datum reference note added before distribution to non-USACE users.

## 20. Datum Reference Note

Whenever maps, site drawings or spatial elevation data are provided to non-USACE users, they should contain a datum note that provides, at minimum, the following information:

The elevations shown are referenced to the [NGVD29] [NAVD88] and are in [feet] [meters]. Differences between NGVD29 and NAVD88 at the center of the project sheet/data set are shown on the diagram below. Datum conversion was performed using the [program VERTCON] [direct leveling connections with published NGS benchmarks] [other]. Metric conversions are based on [US Survey Foot = 1200/3937 meters] [International Survey Foot = 30.48/100 meters].

## 21. Technical Advantages in Converting to NAVD88

There are several compelling reasons that make it advantageous for USACE commands to convert to NAVD88. These include:

- Differential leveling surveys between bench marks will often close better.
- NAVD88 will provide a better reference to estimate GPS-derived orthometric heights.
- IGLD85 will provide a better reference to estimate heights of water-level surfaces on the Great Lakes.
- Data and adjusted height values will be readily available and accessible in convenient form from NGS's Integrated Data Base.
- Federal surveying and mapping agencies will stop publishing on NGVD29 and IGLD55, and will publish only on NAVD88 and IGLD85.
- Surveys performed for the Federal government will require use of NAVD88.
- NAVD88 is recommended by ACSM and FGCS.

## 22. Levels of Effort

For map and site plan drawings, including digital variations thereof, the conversion process entails one of two levels of effort: (1) conversion of all elevations to NAVD88 and re-drawing the map, or (2) simply adding a datum note based on an approximate VERTCON conversion.

## 23. Real Estate Implications

*a.* Surveys, maps and plats prepared in support of civil works and military real estate activities should conform as much as possible with state requirements. Many states are expected to adopt NAVD88 (by statute) as an official vertical reference datum. This likewise will entail a transition to NAVD88 in those states. State and local authorities should therefore be contacted to ascertain their current policies.

*b.* Note that several states have adopted the International Foot for their standard conversion from meters to feet. However, recent action by the FGCS to affirm continued use of the U.S. Survey Foot for Federal surveying activities could lead to a reversal of some state policies.

*c.* In order to avoid dual elevations on USACE survey control points which have multiple uses, it is recommended that published elevations be based on the U.S. Survey Foot. In states where the International Foot is the only accepted standard for boundary and property surveys, conversion of these elevations to NAVD88 should be based on the International Foot while the control remains based on the U.S. Survey Foot.

# SECTION V
# VERTCON 1.0

## 24. General Description of VERTCON

VERTCON is a program developed by the NGS that converts elevation data from NGVD29 to NAVD88. VERTCON uses a simplified transformation of benchmark (BM) heights using a modeled shift for a given area and is, in general, only sufficiently accurate to meet small-scale mapping requirements. VERTCON should not be used for converting benchmark elevations used for site plan design or construction applications. Users can simply input the latitude and longitude for a point and the vertical datum shift between NGVD29 and NAVD88 is output. Data may be input either point-to-point by hand or by batch file. Three batch file formats are supported:

- Free File Format Type 1
- Free File Format Type 2
- NGS Internal BM Format Type 3

A "help" menu in the program gives information and examples of the file formats. Example inputs and outputs for the first two batch file types and a hand input type are included in the following pages. In the existing release, survey points must be input in North American Datum of 1983 (NAD 83) horizontal coordinates. Future releases will convert inputs to NAD 83. This release works on IBM compatible PCs running DOS. VERTCON is command line driven and should be fairly easy to use for anyone with basic computer skills. Batch files are explained in the help menu within the program and can be created through the use of a standard text editor. The command line interface is very basic, but functional.

## 25. USACE Program CORPSCON

VERTCON was released by NGS in early 1993. During the later part of FY94, VERTCON will be incorporated into USACE program CORPSCON, which is currently used for horizontal datum conversions between the North American Datum of 1927 (NAD 27) and NAD 83. CORPSCON can use either geographic, State Plane or UTM coordinates as input/output. Until the revised version of CORPSCON is available, the current version can be used in combination with VERTCON to perform vertical datum conversions with State Plane or UTM inputs.

## 26. VERTCON Installation and Operation Details

Program VERTCON consists of the following files:

VERTCON.EXE - Executable program file
VERTCON.DIR -Directory of VERTCON data base (non-readable, i.e., binary, file)
VERTCON.COF -Coefficients of VERTCON data base (non-readable, i.e., binary, file)
README.TXT -User's instruction file

*a. VERTCON Installation.*

(1) Make sure the original floppy disk is write-protected.

(2) Make a subdirectory on hard disk; for example: "mkdir NGVDCONV" (VERTCON will also run from the floppy disk)

(3) Go into a subdirectory; for example: "cd NGVDCONV"

(4) Copy the floppy disk into the subdirectory; for example: "copy A:*.* *.* /v"

(5) Put the original floppy in a safe place.

*b. VERTCON Execution.* Type "VERTCON" and follow the prompts.

*c. VERTCON Termination.* VERTCON computations can be stopped at any time by the Control-C (i.e., <ctrl-c>) key combination, but interactive processing can be terminated by entering 0. (i.e., zero WITH DECIMAL POINT)

## 27. VERTCON Modeling Procedure

The modeled conversion of NGVD29 normal orthometric heights to NAVD88 Helmert orthometric heights can be accomplished by using the VERTCON software. This conversion is sufficiently accurate for many small-scale mapping purposes. The software and two files of modeling coefficients (data base) for the conterminous United States (CONUS) are provided on the disk.

VERTCON returns the orthometric height difference between NAVD88 and NGVD29 at the geodetic position specified by the user. The root-mean-square (RMS) error of the actual NGVD29/NAVD88 height differences versus the computed height differences from the model for the data points used to create the model is ± 1 cm; the estimated maximum error is ± 2.5 cm. Depending on network design and terrain relief, larger differences (e.g., 5 to 50 cm) may occur the further a bench mark is located from the control points used to establish the model coefficients. For this reason, VERTCON should only be used for approximate conversions where these potential errors are not critical. If feasible, future versions of VERTCON will contain estimates of uncertainty on a region-by-region basis.

## 28. VERTCON Data Input Procedures

The user can key in latitude and longitude on a point-by-point basis or can create an input file using a text editor. Several file formats are provided, including the internal bench mark file record format of the Vertical Network Branch, NGS. These formats are detailed in a "Help" menu option which appears when the input filename is specified. Most horizontal positions of the bench marks used to generate VERTCON were scaled from USGS topographic maps. The estimated uncertainty of the scaled positions is far greater than the differences between NAD 27 and NAD 83. Therefore, the horizontal geodetic datum to which the latitude and longitude are referenced (either NAD 27 or NAD 83) should not adversely affect the computed height difference since the height differences change very little with slight changes in horizontal position, i.e., less than 100 meters.

## 29. VERTCON Data Output

VERTCON Results are collected into an output file. The default name of this file is "VERTCON.OUT", but the user can choose any other legal filename. (Do not use misleading extensions such as *.EXE, *.DIR, *.COF, or *.BAT). The format of the output file is linked to the format of the input file to maintain consistency.

## 30. Derived NAVD88 Heights from NGVD29 Heights

The modeled NAVD88 - NGVD29 height differences convert from NGVD29 normal orthometric heights to NAVD88 Helmert orthometric heights. This value is ADDED ALGEBRAICALLY to NGVD29 normal orthometric heights to obtain NAVD88 Helmert orthometric heights. If a NGVD29 height is desired when a NAVD88 height is given, SUBTRACT the value ALGEBRAICALLY from the NAVD88 height.

## 31. VERTCON Models for CONUS

*a.* Interconnected local VERTCON models were computed in October 1992 using more than 300,500 NAVD88 - NGVD29 orthometric height differences. The aggregate of these local models, defined for 144 Helmert blocks, comprise the total VERTCON model for CONUS. The benefit of developing this mosaic of local models is that any error found locally, such as gross errors and/or an inconsistent leveling network, can be corrected promptly and the data base "repaired" swiftly without affecting any other area.

*b.* The method of computation is based on Professor Rolland L. Hardy's multiquadric method for data modeling and prediction. Accordingly, a set of coefficients of radial basis functions are determined at "optimally" selected data points in a two-dimensional space. These coefficients define an irregular surface which matches the selected data exactly, in this case the NAVD88 - NGVD29 height differences, and approximate the data at varying error levels at other points.

*c.* It is desirable for datum conversion efficiency purposes to model the data field with a minimal set of surface coefficients, while keeping the deviation of the surface at non-selected data points within predefined bounds. This was achieved by an iterative process in which, after a small initial set of data points was modeled, additional data points were gradually added to the model at the locations of largest deviations between model surface and data. This approach provided a minimal set of model coefficients, while maintaining predefined error bounds.

*d.* The data base and VERTCON software are operational on standard disc operating system (DOS) controlled (IBM-compatible) personal computers (PC). However, the executable code and (binary) data base may not be transferable to other systems. In the near future two additional modules will be provided:

(1) CONVASCI -- will extract and store the local models in an ASCII file for transfer to other systems

(2) CONVBIN -- will restore the ASCII file into a two-file binary data base on the new system. The

recompiled VERTCON software can then operate on this data base.

## 32. Future VERTCON Modifications

A continuing development effort is underway to improve VERTCON results. NGVD29 normal orthometric heights are being analyzed for localized monument and/or crustal motion effects, for inconsistent adjustments, and other effects. Computed height differences which are significantly influenced by such effects will be flagged and rated for reliability on the output.

A

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CEMVN-ED

26 October 2000

MEMORANDUM FOR Chief, Engineering Division, Mississippi Valley Division, P. O. Box 80, Vicksburg, MS 39181-0080

SUBJECT: CEMVN-ED Policy Letter of 1985 - NGS Benchmarks

1. Reference subject policy letter, and endorsements thereto, copy attached.

2. The New Orleans District has been abiding by the policy outlined in the referenced letter since its approval by the Division Office. In the 15 years since adopting this policy, the NGS has no longer performed the surveying of our reference benchmarks to publish new epochs and, most assuredly, we have witnessed continued subsidence. Until recently there has been very little alternative for maintaining accurate vertical control.

3. This district has recently hired an expert cartographer and geographer (Mr. Clifford Mugnier) to assist us on this issue. He has presented us with a proposal to implement and operate GPS Continuously Operating Reference Stations (CORS), which will measure gravity and accommodate subsidence, (See Attached, "GPS Leveling In The Gulf Coast Region"). This system will need to be validated with absolute gravity observations. We intend to implement this proposal and to cooperate with state and other federal agencies in South LA in establishing a network of CORS located at sites of mutual benefit. This vertical control network will provide the means for maintaining accurate vertical control.

4. It is becoming increasingly untenable to maintain the existing policy. We are proposing to use the NAVD88 for future work on all projects (Federal Register extract attached). All of our partners are using this datum for their work, and the existing policy is causing great confusion. We propose to abandon the 1985 policy and request your oncurrence. We intend to evaluate the impacts of this on a project-by-project basis, and will take appropriate mitigation actions.

Encls

Robert J Fairless, P.E.
for Gerard S. Satterlee, P.E.
Chief, Engineering Division

CF:
CEMVN-CD
CEMVN-OD
CEMVN-DE

## GPS LEVELING IN THE GULF COAST REGION

The Height Modernization Program of the National Geodetic Survey (NGS) is made possible by the development of "GEOID99," the mathematical model of the equipotential gravity field of the United States. GPS Leveling is a procedure that utilizes this concept, but requires independent validation and observation of benchmark velocities in regions of crustal motion. The ability to independently observe and measure subsidence with changes in Absolute Gravity is a new technology applicable to the Gulf Coast Region. GPS Continuously Operating Reference Stations (CORS) do record the variation in their own three-dimensional coordinates. However only the independent measurement of changes in Absolute Gravity allow the validation of the vertical component of CORS sites in a subsidence-prone region for short-term use. It is thought that 4 to 5 years of CORS site operation in a subsidence area will provide some validation of vertical movement of the CORS site itself, but short-term variations of subsidence rates can be masked by noise. The independent determination of changes in elevation by observing changes in the absolute gravity at the same point provide that physical certainty.

For an area of crustal motion, GPS Leveling must be accomplished by GPS observation of benchmarks for 30 minutes on one day, (say in the morning), and for 30 minutes the following day, in the afternoon. The two observation periods separated by a day insure that the GPS constellation above the observer's local horizon will be substantially different and free of geometric bias in a simultaneous post-processed solution. The maximum distance from a mobile observer using a dual-frequency geodetic survey-grade GPS receiver to a CORS site is 50 statute miles. The accuracy achieved with proper post-processing is **two centimeters vertical**. This represents the state of the art if each CORS site is validated with the observation of Absolute Gravity every year at each CORS site.

The data collected at each CORS site must be edited and adjusted on a daily basis and submitted electronically to the National Geodetic Survey. Acceptance and publication of the observed data from each CORS site by NGS constitutes the establishment of the national infrastructure of geodetic control with today's technology. LSU will provide the daily data processing support, the continuous observation of Absolute Gravity at LSU and on a rotating basis at all CORS sites, and the establishment of fiducial benchmarks. Fiducial benchmarks will be established and periodically re-observed at strategic locations throughout the NOD with GPS Leveling procedures and observation of Absolute Gravity with outdoor portable instruments.

CEMVD-ET-ET (CEMVN-ED/26 Oct 00) 1st End 31 January 2001

MEMORANDUM FOR Commander, New Orleans District, ATTN: CEMVN-ED

SUBJECT: CEMVN-ED Policy Letter of 1985 - NGS Benchmarks

1. We concur with your proposal to use the NAVD88 benchmark information for future work on all projects. Accordingly, the new policy is as follows:

a. All gages will be set to conform to the NAVD88 benchmark information.

b. Main stem features of the MR&T project under construction or to be constructed in the future will utilize the NAVD88 benchmark elevations.

c. Off-main stem projects of the MR&T under construction or to be constructed in the future will use the NAVD88 benchmark data.

d. All O&M dredging will use the NAVD88 benchmark data.

e. Hurricane protection projects under construction or to be constructed in the future will use the NAVD88 benchmark data.

2. We also agree that if CORS proves to be a reliable and accurate system for determining benchmark elevations, MVD and the New Orleans District should re-evaluate the above policy to consider use of the CORS benchmark information in lieu of the NAVD88 benchmark information. Further, the New Orleans District should at that time begin evaluation of completed projects to determine whether or not modifications are necessary to achieve authorized levels of protection.

3. We request that you provide MVD semi-annual status reports on the installation and operation of the CORS. We are interested in confirming its accuracy in determining benchmark information and subsidence rates as well as evaluating its application in other MVD districts.

Encls
nc

MICHAEL P. FALLON, P.E.
Chief, Engineering and
Construction Division

CF:
CECW-EE (M. K. Miles)
CEMVD-PM

CEMVN-ED-S 11 April 2002

MEMORANDUM FOR Branch Chiefs

SUBJECT: Vertical Control and Permanent Benchmarks

1. It is the policy of Engineering Division to use those benchmarks that best define vertical control with respect to the NAVD88 datum. Consequently, all scopes of work for our design contracts that include surveying work must be reviewed by our Survey Section to ensure that the preferred reference benchmarks are clearly and accurately specified.

2. Survey Section personnel or its contractors will visit District benchmarks as they are needed to update their vertical elevations through the use of the Continuously Operating Reference Stations (CORS) associated with LSU's GULFNET system. This system allows us to more accurately define vertical elevations and will provide information to predict future subsidence.

3. For all Engineering Division products, please coordinate with Survey Section for their involvement and to budget against the benefiting projects for these efforts.

GERARD S. SATTERLEE, JR.
Chief, Engineering Division

20 December 2002

CEMVN-ED-S

MEMORANDUM FOR : Engineering Division, Branch Chiefs, Section Chiefs, Functional Team Leaders (FTLs) and Technical Managers

SUBJECT: Vertical Datum Policy

1. It is the policy of Engineering Division to use the NAVD88 datum for all vertical control and for gages, for engineering studies, design and construction documents and for the reporting of all levels of protection, etc. All new work shall be requested in NAVD88.

2. The Survey Section shall not sanction mathematical conversions to the NAVD88 datum from permanent benchmark elevations published in the NGVD29 datum. Prior to any field data collection effort either in-house, through contracts, by sponsors or their AEs, the project shall fund to validate benchmarks and to establish vertical controls in the project area.

3. Historic data to include topographic and hydrographic surveys, flowlines, hydrologic data, benchmarks, map elevation contours, and all such field information collected using non-NAVD88 datums is suspect and cannot easily be used in conjunction with current NAVD88 data. No meaningful conversion between old datums and NAVD88 is possible without proper field investigations and even then could result in an approximation at best. Therefore, Survey Section will be consulted for each instance of attempted use of historic data. The degree of their involvement will depend on the purpose for which the data is to be used and the acceptable magnitude of error. As a minimum, a quick validation of the vicinity benchmark elevation without cost to the project is required to determine the magnitude of the problem.

4. It is recognized that some interim exceptions to this policy may be necessary. These should be expressly approved by the Chief, Engineering Division.

5. To ensure adherence to proper surveying practices, the use of acceptable benchmarks and their assigned values, and the conformance of the data to Corps standards and datums, all planned field surveying effort shall be reviewed by the Chief, Surveying Section. This includes the field data gathering effort performed by District design and planning AE contractors, sponsors, and the sponsor's AE contractors.

6. Plans and specifications shall identify the permanent benchmarks and their assigned elevations to be used for each construction contract. It will be incumbent upon the design engineer to assure that all designs and data are compatible with the elevations assigned to the permanent benchmarks used in the contract documents.

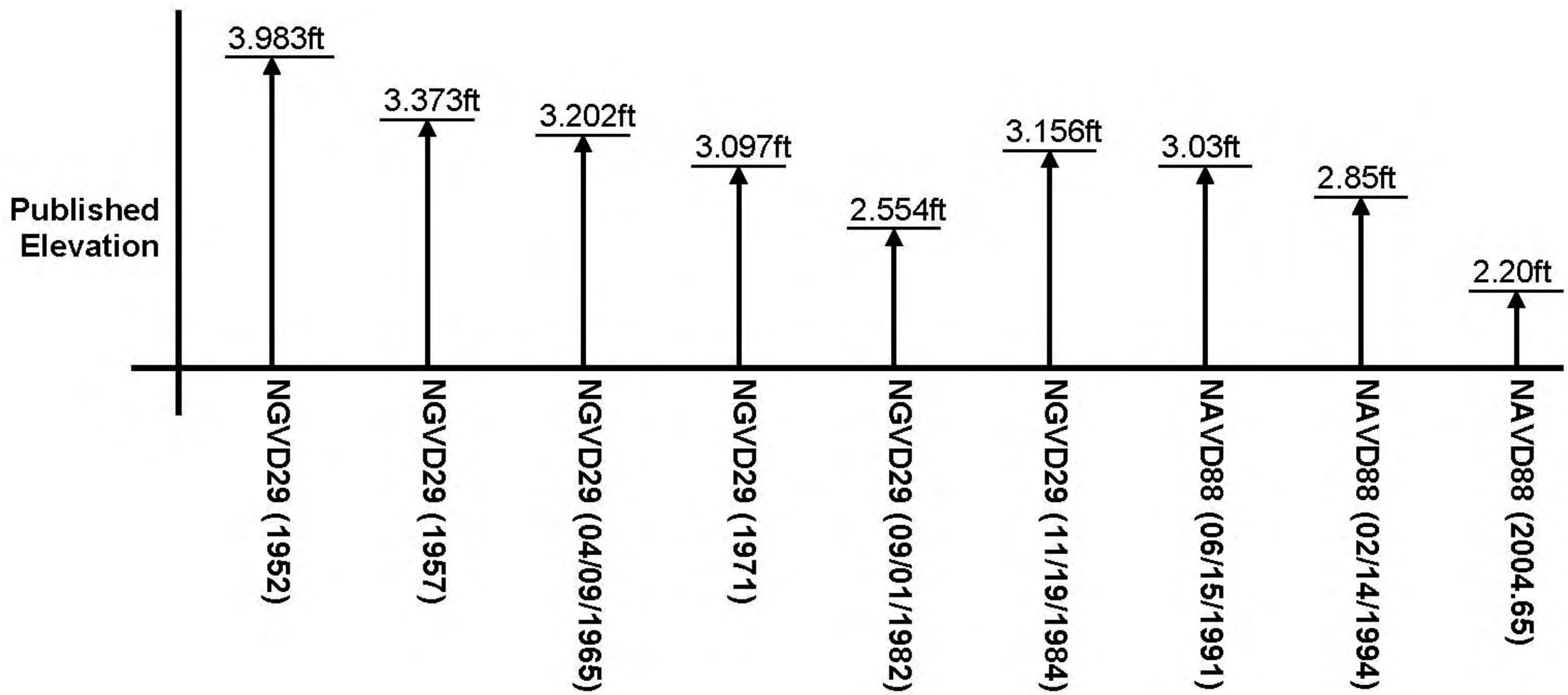
7. It is the intent of this policy that the assigned benchmark elevations represent a "snapshot", and may change on future contracts depending on benchmark movement. Engineers must use sound engineering judgment in employing the NAVD88 datum, recognizing that projects have already been designed and/or constructed using the NGVD29 datum against various epochs and that projects may require a significant number of years from conception to completion, and therefore allowances must be made for vertical movement.

/s/
GERARD S. SATTERLEE, Jr.
Chief, Engineering Division

CF: CEMVN-OD
CEMVN-PA
CEMVN-PM
CEMVN-CD

# Appendix 41
# Benchmark History

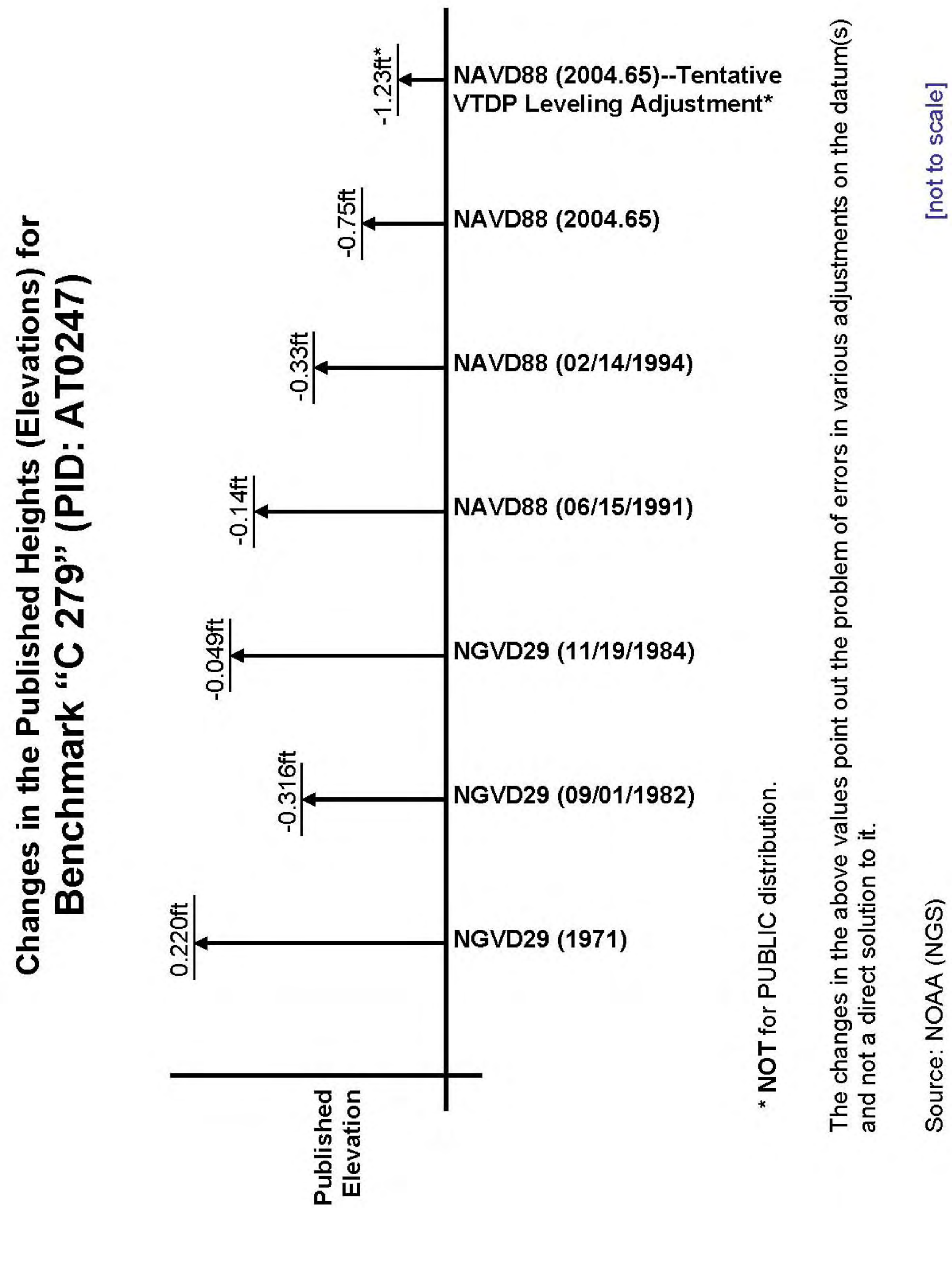
## Changes in the Published Heights (Elevations) for Benchmark "A 152" (PID: AT0407)



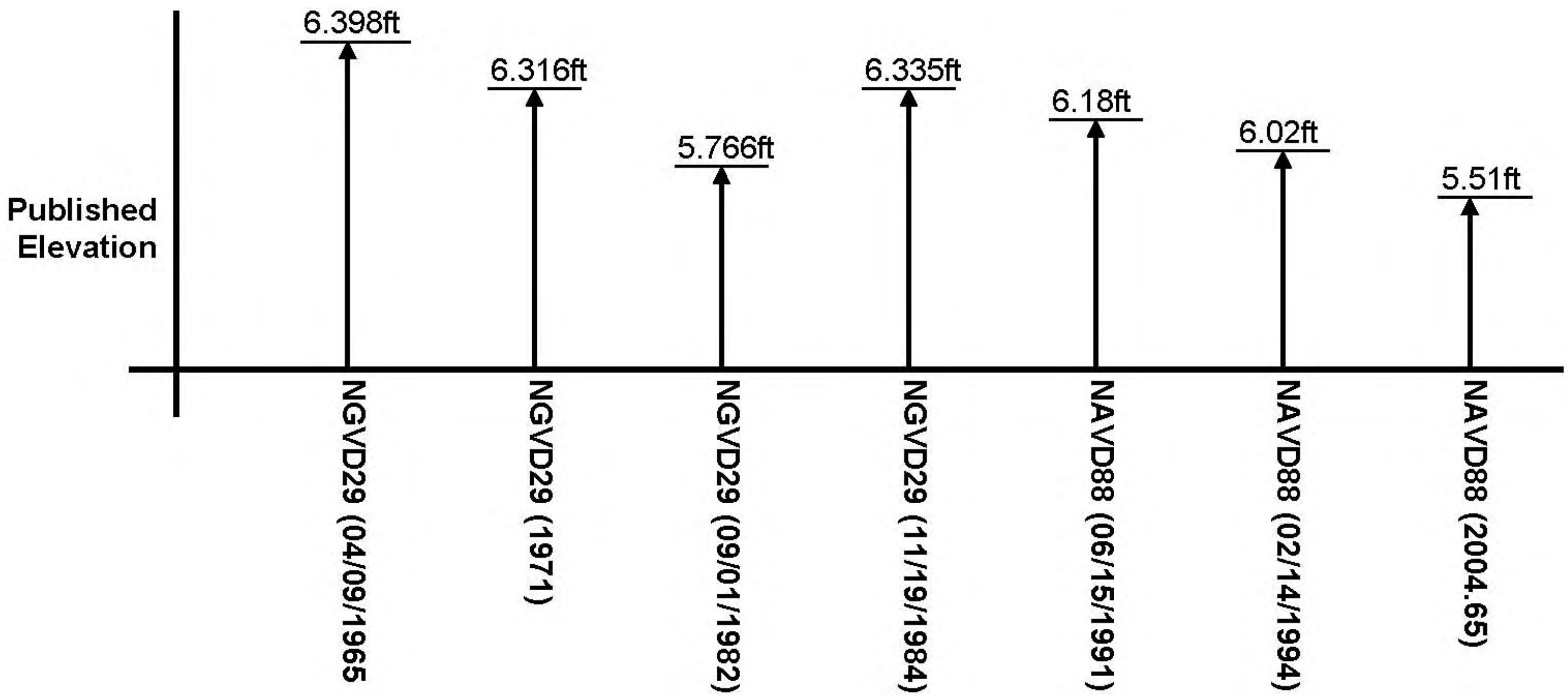

The changes in the above values point out the problem of errors in various adjustments on the datum(s) and not a direct solution to it.

Source: NOAA (NGS)

[not to scale]


Changes in the Published Heights (Elevations) for
Benchmark "C 279" (PID: AT0247)
Published Elevation
0.220ft
NGVD29 (1971)
-0.316ft
NGVD29 (09/01/1982)
-0.049ft
NGVD29 (11/19/1984)
-0.14ft
NAVD88 (06/15/1991)
-0.33ft
NAVD88 (02/14/1994)
-0.75ft
NAVD88 (2004.65)
-1.23ft*
NAVD88 (2004.65)--Tentative VTDP Leveling Adjustment*
* NOT for PUBLIC distribution.
The changes in the above values point out the problem of errors in various adjustments on the datum(s) and not a direct solution to it.
Source: NOAA (NGS)
[not to scale]

## Changes in the Published Heights (Elevations) for Benchmark "D 194" (PID: AT0357)




The changes in the above values point out the problem of errors in various adjustments on the datum(s) and not a direct solution to it.

Source: NOAA (NGS)

[not to scale]

## Changes in the Published Heights (Elevations) for
# Benchmark “EMPIRE AZ MK 2 1934 1966” (PID: AT0231)


* **NOT** for PUBLIC distribution.

The changes in the above values point out the problem of errors in various adjustments on the datum(s) and not a direct solution to it.

Source: NOAA (NGS)

[not to scale]

| | | Lat-NAD83(92) | Long-NAD83(92) | Horiz | NAVD88 (2004.65) | | Vertical | Method/Procedure | Louisiana | Ellipsoid (GPS Obs) |
|---|---|---|---|---|---|---|---|---|---|---|
| PID | Designation | DD.DDDD | DD.DDDD | Order | meters | feet | Order | From Datasheet | GEOID03 | From Datasheet |
| AT0200 | MILAN 2 | 29.4682621333 | -89.6815916444 | B | -0.15 | -0.49 | 3 | GPS OBS(2004.65) | -24.39 | -24.53 |
| AT0231 | EMPIRE AZ MK2 1934 1966 | 29.3939292278 | -89.6031577194 | B | -0.01 | -0.03 | 3 | GPS OBS(2004.65) | -24.21 | -24.22 |
| AT0247 | C 279 | 29.3639730028 | -89.5562293111 | B | -0.23 | -0.75 | 3 | GPS OBS(2004.65) | -24.15 | -24.37 |
| AT0332 | L 278 | 29.8761587556 | -89.8959403194 | B | 2.11 | 6.92 | 3 | LEVELING(2004.65) | -25.80 | -23.69 |
| AT0351 | N 278 | 29.8751651556 | -89.9561699389 | B | 1.46 | 4.79 | 3 | LEVELING(2004.65) | -25.81 | -24.36 |
| AT0367 | D 194 | 29.8603361972 | -89.9709732444 | B | 1.68 | 5.51 | 3 | LEVELING(2004.65) | -25.77 | -24.08 |
| AT0376 | R 194 | 29.7295593389 | -89.9880977611 | B | 1.39 | 4.56 | 3 | GPS OBS(2004.65) | -25.32 | -23.92 |
| AT0407 | A 152 | 29.6246079278 | -89.9029636500 | B | 0.67 | 2.20 | 3 | GPS OBS(2004.65) | -24.93 | -24.25 |
| AT0458 | C 195 | 29.5367786222 | -89.7630989000 | B | 0.48 | 1.57 | 3 | GPS OBS(2004.65) | -24.60 | -24.12 |
| AT0685 | 876 1724 TIDAL 11 | 29.2647997583 | -89.9575226583 | B | 0.95 | 3.12 | 3 | GPS OBS(2004.65) | -23.99 | -23.03 |
| AT0731 | N 367 | 29.3523048000 | -89.4571321222 | B | 0.34 | 1.12 | 3 | GPS OBS(2004.65) | -24.13 | -23.78 |
| AT0733 | J 370 | 29.3172995944 | -89.3882771417 | B | -1.23 | -4.04 | 3 | GPS OBS(2004.65) | -24.05 | -25.27 |
| AT0760 | V 375 | 29.9170974167 | -89.9716783833 | B | 0.71 | 2.33 | 1 | GPS OBS(2004.65) | -25.95 | -25.24 |
| AT0804 | REGGIO 2 | 29.8446442111 | -89.7590085528 | B | 1.52 | 4.99 | | GPS OBS(2004.65) | -25.68 | -24.15 |
| AT1390 | 876 0849 A TIDAL | 29.2668133472 | -89.3528765389 | B | 0.85 | 2.79 | 3 | GPS OBS(2004.65) | -23.96 | -23.10 |
| AU0179 | B 201 | 29.7076271556 | -91.3833285889 | B | 2.71 | 8.89 | 3 | LEVELING(2004.65) | -25.62 | -22.89 |
| AU0193 | V 275 | 29.7145785361 | -91.3007900667 | B | 2.00 | 6.56 | 1 | GPS OBS(2004.65) | -25.62 | -23.60 |
| AU0218 | F 198 | 29.6941022000 | -91.2044650139 | B | 2.38 | 7.81 | 1 | GPS OBS(2004.65) | -25.55 | -23.16 |
| AU0272 | X 276 | 29.7370463111 | -90.8376351694 | B | 1.63 | 5.35 | 3 | GPS OBS(2004.65) | -25.61 | -23.97 |
| AU0286 | CLUB | 29.7856167389 | -90.7847187861 | B | 4.69 | 15.39 | 1 | GPS OBS(2004.65) | -25.72 | -21.02 |
| AU0316 | G 165 | 29.8327134639 | -90.4616471750 | B | 0.37 | 1.21 | 3 | LEVELING(2004.65) | -25.79 | -25.43 |
| AU0332 | E 299 | 29.9139278417 | -90.3448889222 | B | 0.70 | 2.30 | 1 | GPS OBS(2004.65) | -25.98 | -25.28 |
| AU0429 | A 148 | 29.9891631500 | -90.0872819222 | B | 1.77 | 5.81 | 1 | GPS OBS(2004.65) | -26.15 | -24.38 |
| AU0520 | S 188 | 29.9667534806 | -90.2292513139 | B | 2.35 | 7.71 | 1 | GPS OBS(2004.65) | -26.11 | -23.75 |
| AU0663 | H 152 | 29.9638057806 | -90.0277441750 | B | 6.10 | 20.01 | 1 | GPS OBS(2004.65) | -26.09 | -19.96 |
| AU1091 | F 220 | 29.6052082750 | -90.4898549306 | B | 1.70 | 5.58 | 3 | LEVELING(2004.65) | -25.26 | -23.57 |
| AU1126 | R 155 | 29.5460637000 | -90.3390951667 | B | 1.26 | 4.13 | 3 | LEVELING(2004.65) | -25.03 | -23.77 |
| AU1255 | JESSE | 29.2360630222 | -90.2097757806 | B | 0.37 | 1.21 | 3 | LEVELING(2004.65) | -24.12 | -23.74 |
| AU1291 | N 221 | 29.2045855111 | -90.0400717583 | B | 1.66 | 5.45 | 3 | GPS OBS(2004.65) | -23.91 | -22.25 |
| AU1299 | G 233 | 29.4993657278 | -90.5771826000 | B | 1.04 | 3.41 | 3 | LEVELING(2004.65) | -25.05 | -24.01 |
| AU1309 | S 233 | 29.3857599861 | -90.6200770056 | B | 2.91 | 9.55 | 3 | GPS OBS(2004.65) | -24.80 | -21.89 |
| AU1415 | R 227 | 29.6056470139 | -90.8388095833 | B | 1.47 | 4.82 | 3 | GPS OBS(2004.65) | -25.33 | -23.86 |
| AU1436 | Z 221 | 29.5889817778 | -90.7204120361 | B | 1.46 | 4.79 | 1 | GPS OBS(2004.65) | -25.28 | -23.82 |
| AU1510 | 1942 CAP | 29.9956475833 | -90.8130993667 | B | 5.69 | 18.67 | 3 | LEVELING(2004.65) | -26.29 | -20.59 |
| AU1624 | P 228 | 29.9416790028 | -91.0230323861 | B | 5.82 | 19.09 | 3 | LEVELING(2004.65) | -26.21 | -20.37 |
| AU2014 | B 368 | 29.7277591306 | -90.5979617944 | B | 3.24 | 10.63 | 3 | LEVELING(2004.65) | -25.55 | -22.32 |
| AU2028 | G 368 | 29.4607947306 | -90.3086571833 | B | 0.82 | 2.69 | 3 | LEVELING(2004.65) | -24.79 | -23.97 |
| AU2033 | O 369 | 29.3352485694 | -90.2431730528 | B | 0.92 | 3.02 | 3 | LEVELING(2004.65) | -24.41 | -23.47 |
| AU2042 | H 369 | 29.1572558944 | -90.1754296194 | B | 1.45 | 4.76 | 3 | LEVELING(2004.65) | -23.92 | -22.47 |
| AU2110 | G 365 | 29.9109779833 | -90.2128631222 | B | 0.24 | 0.79 | 1 | GPS OBS(2004.65) | -25.97 | -25.72 |
| AU2123 | O 368 | 29.8758511917 | -90.1153382250 | B | 0.71 | 2.33 | 3 | LEVELING(2004.65) | -25.85 | -25.11 |
| AU2163 | B 369 | 29.7681857250 | -90.1004690194 | B | 1.84 | 6.04 | 3 | LEVELING(2004.65) | -25.50 | -23.67 |
| AU2310 | 876 1899 B TIDAL | 29.6672347528 | -90.1093213722 | B | 0.01 | 0.03 | 3 | LEVELING(2004.65) | -25.19 | -25.17 |
| AU3293 | DREUX 2 | 29.2899859472 | -90.6483944806 | B | 0.59 | 1.94 | | GPS OBS(2004.65) | -24.58 | -23.98 |
| AU3539 | SAVOIE RESET | 29.6462967667 | -90.6885348000 | B | 2.01 | 6.59 | | GPS OBS(2004.65) | -25.39 | -23.38 |
| BH1119 | C 189 | 30.0734719417 | -89.8405278111 | B | 0.63 | 2.07 | 3 | LEVELING(2004.65) | -26.34 | -25.72 |
| BH1164 | PIKE RESET | 30.1665773833 | -89.7374082250 | B | 2.48 | 8.14 | 1 | GPS OBS(2004.65) | -26.57 | -24.06 |
| BH1212 | A 193 | 30.2387229806 | -89.6195575556 | B | 0.75 | 2.46 | 3 | LEVELING(2004.65) | -26.83 | -26.03 |
| BH1890 | WASTE WELL 2 RESET | 30.0229762667 | -89.9129994472 | B | 1.43 | 4.69 | 1 | GPS OBS(2004.65) | -26.22 | -24.80 |
| BJ0634 | R 295 | 30.1066175194 | -90.9855980417 | B | 9.24 | 30.31 | 1 | GPS OBS(2004.65) | -26.65 | -17.39 |
| BJ0710 | G 95 | 30.0006535250 | -90.4291464278 | B | 8.27 | 27.13 | 3 | LEVELING(2004.65) | -26.20 | -17.94 |
| BJ1112 | RIVER MISSISSIPPI MP 65 | 30.0823575778 | -90.9029672444 | B | 6.14 | 20.14 | 3 | LEVELING(2004.65) | -26.54 | -20.39 |
| BJ1342 | ALCO | 30.0268119250 | -90.1128362583 | B | 1.87 | 6.14 | 3 | LEVELING(2004.65) | -26.24 | -24.37 |
| BJ1655 | E 191 | 30.0186886111 | -90.7307153056 | B | 4.39 | 14.40 | 3 | LEVELING(2004.65) | -26.32 | -21.93 |
| BJ3744 | S 379 | 30.0509420583 | -90.5404715306 | B | 4.31 | 14.14 | | GPS OBS(2004.65) | -26.34 | -22.03 |

| | Superseded NAVD88; Source: NGS | | | | LOCAL TIDAL | Superseded and Historical NGVD29 ; Source: NGS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PID | 08/31/01 | 12/05/96 | 02/14/94 | 06/15/91 | 04/21/03 | 12/01/98 | 05/21/91 | 02/23/90 | 10/12/88 | 11/20/87 | 01/30/86 | Date Unknown | 11/19/84 | 05/02/83 | 09/01/82 | 1971 | 1969 | 04/09/65 | 1957 | 1957 | 1952 |
| AT0200 | | | 0.02 | 0.20 | | | | | | | | 0.30 | 0.30 | | 0.00 | 0.54 | | | | | |
| AT0231 | | | 0.42 | 0.61 | | | | | | | | | 0.71 | | 0.37 | 0.91 | | | | | |
| AT0247 | | | -0.33 | -0.14 | | | | | | | | | -0.05 | | -0.32 | 0.22 | | | | | |
| AT0332 | | | 7.39 | 7.58 | | | | | | | | | 7.74 | | 7.18 | 7.73 | | | | | |
| AT0351 | | | 5.32 | 5.48 | | | | | | | | 5.63 | | | | | | | | | |
| AT0367 | | | 6.02 | 6.18 | | | | | | | | | 6.34 | | 5.77 | 6.32 | | 6.40 | | | |
| AT0376 | | | 5.10 | 5.27 | | | | | | | | | 5.41 | | 4.74 | 5.29 | | 5.33 | | | |
| AT0407 | | | 2.85 | 3.03 | | | | | | | | | 3.16 | | 2.55 | 3.10 | | 3.20 | | 3.37 | 3.98 |
| AT0458 | | | 2.31 | 2.49 | | | | | | | | 2.60 | | | | | | | | | |
| AT0685 | | | 3.99 | 3.95 | 2.91 | | | | | | | | | | 3.69 | | | | | | |
| AT0731 | | | 1.54 | 1.73 | | | | | | | | | 1.82 | | | | | | | | |
| AT0733 | | | -3.99 | -3.81 | | | | | | | | -3.72 | | | | | | | | | |
| AT0760 | | 2.92 | 2.86 | | | | 3.06 | | | | | | | | | | | | | | |
| AT0804 | | | 5.62 | | | | | 6.00 | 5.97 | | | | | | | | | | | | |
| AT1390 | 3.19 | | | | | 3.43 | | | | | | | | | | | | | | | |
| AU0179 | | | 9.57 | 9.76 | | | | | | | | 9.90 | | | | | | | | | |
| AU0193 | | | 7.37 | 7.59 | | | | | | | | 7.72 | | | | | | | | | |
| AU0218 | | | 8.55 | 8.64 | | | | | | | | 8.80 | | | | | | | | | |
| AU0272 | | | 6.13 | 6.31 | | | | | | | | 6.42 | | | | | | | | | |
| AU0286 | | | 16.30 | 16.49 | | | | | | | | 16.57 | | | | | | | | | |
| AU0316 | | 1.58 | 1.67 | 1.86 | | | | | | | | 1.98 | | | | | | | | | |
| AU0332 | | 2.72 | 2.66 | 2.85 | | | | | | | | 2.96 | | | | | | | | | |
| AU0429 | | 6.28 | 6.26 | 6.46 | | | 6.45 | | | | 6.66 | | 6.66 | | 6.61 | 6.93 | 6.99 | 7.12 | 7.31 | 7.34 | 7.95 |
| AU0520 | | 8.10 | 8.01 | 8.20 | | | | | | | | 8.37 | | | | | | | | | |
| AU0663 | | 20.63 | 20.57 | | | | 20.77 | | | | | | | | | | | | | | |
| AU1091 | | | 6.20 | 6.45 | | | | | | | | 6.46 | | | | | | | | | |
| AU1126 | | | 4.80 | 5.07 | | | | | | | | 5.03 | | | | | | | | | |
| AU1255 | | | 1.88 | 2.14 | | | | | | | | 1.98 | | | | | | | | | |
| AU1291 | | | 6.17 | 6.40 | | | | | | | | 6.15 | | | | | | | | | |
| AU1299 | | | 4.01 | | | | | | | | | 4.00 | | | | | | | | | |
| AU1309 | | | 10.16 | | | | | | | | | 10.57 | | | | | | | | | |
| AU1415 | | | 5.71 | 6.27 | | | | | | | | 6.39 | | | | | | | | | |
| AU1436 | | | 5.41 | 5.77 | | | | | | | | 5.87 | | | | | | | | | |
| AU1510 | | | 19.55 | | | | | | | | | 20.14 | | | | | | | | | |
| AU1624 | | | 19.92 | | | | | | | | | 20.14 | | | | | | | | | |
| AU2014 | | 11.08 | 11.29 | 11.57 | | | | | | | | 11.64 | | | | | | | | | |
| AU2028 | | | 3.30 | 3.50 | | | | | | | | 3.43 | | | | | | | | | |
| AU2033 | | | 3.68 | 3.93 | | | | | | | | 3.81 | | | | | | | | | |
| AU2042 | | | 5.38 | 5.59 | | | | | | | | 5.39 | | | | | | | | | |
| AU2110 | | 1.12 | 1.03 | 1.22 | | | | | | | | 1.34 | 1.34 | | | | | | | | |
| AU2123 | | 2.80 | 2.68 | 2.87 | | | | | | | | 2.98 | | | | | | | | | |
| AU2163 | | 6.48 | 6.33 | | | | | | 6.63 | | | | 6.63 | | | | | | | | |
| AU2310 | | 0.46 | 0.31 | | | | | | 0.61 | | | | | | | | | | | | |
| AU3293 | | | 2.30 | | | | | | | | | | | | | | | | | | |
| AU3539 | | | 7.31 | | | | | | | 8.3 | | | | | | | | | | | |
| BH1119 | | 2.60 | 2.59 | 2.66 | | | 2.79 | | | | 2.84 | | | 2.64 | 2.64 | 2.84 | 2.86 | 2.91 | | | |
| BH1164 | | 8.63 | 8.58 | 8.69 | | | 8.79 | | | | | | | | | | | | | | |
| BH1212 | | | 2.88 | 2.88 | | | | | | | | | | | 2.75 | 3.07 | 3.07 | 3.07 | | | |
| BH1890 | | 5.32 | 5.36 | | | | 5.56 | | | | | | | | | | | | | | |
| BJ0634 | | | 31.07 | | | | | | | | | 31.22 | | | | | | | | | |
| BJ0710 | | | 27.83 | | | | | | | | | 28.14 | | | | | | | | | |
| BJ1112 | | | 20.84 | | | | | | | | | 21.21 | | | | | | | | | |
| BJ1342 | | 6.59 | 6.57 | | | | 6.76 | | | | 6.95 | | 6.87 | | | | | 7.38 | 7.62 | | 8.24 |
| BJ1655 | | | 15.16 | | | | | | | | | 15.59 | | | | | | | | | |
| BJ3744 | | | 14.70 | | | | | | | | | | | | | | | | | | |

| | Prior NGVD29 Epochs (ft) Source: MVN | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PID | 2002 | 1988 | 1986 | 1985 | 1984 | 1983 | 1976 | 1971 | 1970 | 1969 | 1967 | 1966 | 1964 | 1957 | 1955 | 1951 | 1938 |
| AT0200 | | | | | 0.302 | 0.004 | | 0.545 | | | | | | | | | |
| AT0231 | | | | | | 0.778 | | | | | | | | | | | 2.24 |
| AT0247 | | | 0.008 | 0.19 | -0.049 | -0.316 | | 0.220 | | | | | | | | | |
| AT0332 | | | | | 7.736 | 7.181 | | 7.730 | | | | | | | | | |
| AT0351 | | | | | 5.63 | 5.059 | | 5.610 | | | | | | | | | |
| AT0367 | | | | | 6.335 | 5.766 | | 6.316 | | | | | 6.398 | | | | |
| AT0376 | | | | | 5.404 | 4.742 | | 5.289 | | | | | 5.331 | | | | |
| AT0407 | | | | | 3.153 | 2.554 | | 3.097 | | | | | 3.202 | | | 3.373 | |
| AT0458 | | | | | 2.605 | 2.311 | | 2.854 | | | | | 3.064 | | | | |
| AT0685 | | | | | | | | | | | | | | | | | |
| AT0731 | | | | | 1.818 | | | | | | | | | | | | |
| AT0733 | | | | | -3.72 | | | | | | | | | | | | |
| AT0760 | | | | 3.261 | | | | | | | | | | | | | |
| AT0804 | | | | | | | | | | | | | | | | | |
| AT1390 | 2.971 | | | | 3.536 | | 4.071 | | | | | | | | | | |
| AU0179 | | | | | | 9.898 | 10.089 | | 10.164 | | | 10.243 | | | | | |
| AU0193 | | | | | | 7.723 | 7.887 | | 8.091 | | | | | | | | |
| AU0218 | | | | | | 8.796 | 8.917 | | 8.894 | | | 8.940 | | | | | |
| AU0272 | | | | | | 6.417 | 6.575 | | 6.650 | | | | | | | | |
| AU0286 | | | | | | 16.571 | 16.732 | | | | | | | | | | |
| AU0316 | | | | | | 1.982 | 2.077 | | | 2.195 | | | 2.274 | | 2.244 | | |
| AU0332 | | | | | | 2.953 | 3.094 | | | | | | | | | | |
| AU0429 | | | | 6.657 | | 6.61 | 6.804 | 6.929 | | 6.991 | | | 7.123 | | 7.306 | 7.343 | |
| AU0520 | | | | 8.366 | | 8.178 | | 8.363 | | 8.363 | | | 8.363 | | | | |
| AU0663 | | | | 20.978 | | 21.082 | | | | | | | 21.808 | | | 22.169 | |
| AU1091 | | | | | | 6.46 | | | | | | 6.942 | | | | | |
| AU1126 | | | | | | 5.026 | | | | | | 5.558 | | | | | |
| AU1255 | | | | | | 1.975 | | | | | | 2.799 | | | | | |
| AU1291 | | | | | | 6.155 | | | | | | 7.169 | | | | | |
| AU1299 | | | | | | 3.999 | | | | | | 4.898 | | | | | |
| AU1309 | | | | | | 10.571 | | | | | | 11.467 | | | | | |
| AU1415 | | | | | | 6.391 | | | | | | 6.952 | | | | | |
| AU1436 | | | | | | 5.866 | | | | | | 6.755 | | | | | |
| AU1510 | | | | | | 20.144 | | | | | | | | | | | |
| AU1624 | | | | | | 20.141 | | | | | 20.203 | | | | | | |
| AU2014 | | | | | | 11.637 | | | | | | | | | | | |
| AU2028 | | | | | | 3.432 | | | | | | | | | | | |
| AU2033 | | | | | | 3.802 | | | | | | | | | | | |
| AU2042 | | | | | | 5.39 | | | | | | | | | | | |
| AU2110 | | | | | 1.332 | | | | | | | | | | | | |
| AU2123 | | | | | 2.982 | | | | | | | | | | | | |
| AU2163 | | | | | 6.627 | | | | | | | | | | | | |
| AU2310 | | | | | | | | | | | | | | | | | |
| AU3293 | | | | | | | | | | | | | | | | | |
| AU3539 | | | | | | 8.307 | | | | | | | | 8.757 | | | |
| BH1119 | | | | 2.835 | | 2.639 | 2.877 | 2.844 | | 2.858 | | | 2.91 | | | | |
| BH1164 | | | | 8.881 | | 8.601 | 8.865 | | | | | | | | | | |
| BH1212 | | 2.88 | | | | 2.743 | 3.028 | 3.071 | | | | | | | | | |
| BH1890 | | | | 5.466 | | 5.468 | | 5.755 | | 5.807 | | | | | | | |
| BJ0634 | | | | | | 31.214 | 31.427 | | | | | | | | | | |
| BJ0710 | | | | 28.143 | | 28.143 | 28.300 | | | | | | 28.218 | | | 28.241 | 28.806 |
| BJ1112 | | | | | | | | | | | | | | | | | |
| BJ1342 | | | | 6.955 | | 6.869 | | | | | | | 7.375 | | | 7.621 | |
| BJ1655 | | | | | | 15.591 | | | | | 15.673 | | | | | | |
| BJ3744 | | | | | | | | | | | | | | | | | |

# Appendix 42
# Leveling Abstracts

```
   Windows Abstra Version 2.3 -- Jan 1, 2004  Mon May 01 15:59:23 2006


                            -*- FIELD ABSTRACT -*-
060110-060110          HGZ L26879  1     6.0 MM ORDER 2 CLASS 1     PAGE  1
LEVELING AT TIDE STATION 876 1678 MICHOUD SUBSTATION ICWW

        FROM           START   F/B  DIST   ELEV DIFF      -(F+B)  MEAN DIFF   I
             TO                    TOTAL                   TOTAL   FLD ELEV   C
                                    (KM)      (MT)          (MM)     (MT)

 0001 WES 19                                                        -0.11300
--  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --
 0001 WES 19           1100750 B    0.26    -3.19270  *    0.19      3.19261  1
 0002 876 1678 A TIDAL 1100936 F    0.26     3.19252  *                       1
                          SL 1      0.26                   0.19      3.07961
--  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --
 0001 WES 19           1100819 F    0.37    -0.28700  *    0.09     -0.28696  1
 0004 876 1678 WES 17  1100917 B    0.37     0.28691  *                       1
                                    0.37                   0.09     -0.39996
--  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --
 0004 876 1678 WES 17  1100842 F    0.21     1.14050  *    0.00      1.14050  1
 0003 D 276            1100903 B    0.21    -1.14051  *                       1
                                    0.57                   0.09      0.74054
      ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction


  INSTRUMENT CODE      INSTRUMENT              RODS

           1          243 - 333294    396 - 24167     396 - 24168

                        LEVEL LINE SECTION RUNNING TREE

  0001 (0002)
  0004
  0003
  FROM   TO        N. LATITUDE   W. LONGITUDE   FIELD DISTANCE VS. COMPUTED

        0001           300025        0895619          0.00        0.00
  0001  0002           300024        0895615          0.26        0.11
  0001  0004           300037        0895622          0.37        0.38
  0004  0003           300043        0895623          0.21        0.19
    Windows Abstra Version 2.3 -- Jan 1, 2004 -- Mon May 01 15:59:23 2006

   SECTION
  FROM  TO                    E R R O R  M E S S A G E S
```

```
   Windows Abstra Version 2.3 -- Jan 1, 2004  Wed Apr 19 12:31:34 2006

                            -*- FIELD ABSTRACT -*-
060107-060107          HGZ L26879  2     6.0 MM ORDER 2 CLASS 1     PAGE  1
LEVELING AT TIDE STATION 876 1402 THE RIGOLETS

        FROM           START   F/B  DIST   ELEV DIFF      -(F+B)  MEAN DIFF   I
             TO                    TOTAL                   TOTAL   FLD ELEV   C
                                    (KM)     (MT)          (MM)     (MT)

 0001 PIKE RM 3                                                     2.80200
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 PIKE RM 3        1070933 B    0.04     0.30480  *    0.00     -0.30480  1
 0003 PIKE RESET       1071025 F    0.04    -0.30480  *                       1
                          SL 1      0.04                   0.00      2.49720
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 PIKE RM 3        1070948 F    0.03    -0.21800  *   -0.10     -0.21805  1
 0002 C 193            1071015 B    0.03     0.21810  *                       1
                                    0.03                  -0.10      2.58395
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0002 C 193            1071000 F    0.05     0.07320  *    0.10      0.07325  1
 0004 PIKE RM 4        1071009 B    0.05    -0.07330  *                       1
                                    0.08                  -0.00      2.65720
      ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction

  INSTRUMENT CODE      INSTRUMENT              RODS

           1          243 - 333294    396 - 24167     396 - 24168

                        LEVEL LINE SECTION RUNNING TREE

  0001 (0003)
  0002
  0004
  FROM   TO        N. LATITUDE   W. LONGITUDE   FIELD DISTANCE VS. COMPUTED

        0001           300959        0894415           0.00        0.00
  0001  0003           300959        0894414           0.04        0.03
  0001  0002           301000        0894415           0.03        0.03
  0002  0004           300959        0894414           0.05        0.04
    Windows Abstra Version 2.3 -- Jan 1, 2004 -- Wed Apr 19 12:31:34 2006

   SECTION
  FROM  TO                    E R R O R  M E S S A G E S
```

Windows Abstra Version 2.3 -- Jan 1, 2004  Thu May 04 11:44:09 2006

-*- FIELD ABSTRACT -*-

060116-060116          HGZ L26879  3     6.0 MM ORDER 2 CLASS 1     PAGE  1

LEVELING AT TIDE STATION 876 1602 LAKE JUDGE PEREZ

| FROM / TO | START | F/B | DIST TOTAL (KM) | ELEV DIFF (MT) | | -(F+B) TOTAL (MM) | MEAN DIFF FLD ELEV (MT) | I C |
|---|---|---|---|---|---|---|---|---|
| 0002 876 1602 C TIDAL | | | | | | | 0.16300 | |
| 0002 876 1602 C TIDAL | 1160900 | B | 0.10 | -0.25420 | * | 0.10 | 0.25415 | 1 |
| 0006 876 1602 F TIDAL | 1160910 | F | 0.10 | 0.25410 | * | | | 1 |
| | | | 0.10 | | | 0.10 | 0.41715 | |
| 0006 876 1602 F TIDAL | 1160830 | B | 0.24 | 0.13230 | * | -0.40 | -0.13209 | 1 |
| 0005 876 1602 E TIDAL | 1160923 | F | 0.24 | -0.13189 | * | | | 1 |
| | | | 0.34 | | | -0.30 | 0.28506 | |
| 0005 876 1602 E TIDAL | 1160811 | B | 0.20 | 0.06680 | * | 0.40 | -0.06700 | 1 |
| 0004 876 1602 B TIDAL | 1160958 | F | 0.20 | -0.06720 | * | | | 1 |
| | | | 0.54 | | | 0.09 | 0.21806 | |
| 0004 876 1602 B TIDAL | 1160747 | B | 0.07 | 0.03630 | * | 0.00 | -0.03630 | 1 |
| 0003 876 1602 A TIDAL | 1161015 | F | 0.07 | -0.03630 | * | | | 1 |
| | | | 0.61 | | | 0.09 | 0.18176 | |

ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction

| INSTRUMENT CODE | INSTRUMENT | RODS | |
|---|---|---|---|
| 1 | 243 - 333294 | 396 - 24167 | 396 - 24168 |

LEVEL LINE SECTION RUNNING TREE

0002
0006
0005
0004
0003

| FROM | TO | N. LATITUDE | W. LONGITUDE | FIELD DISTANCE | VS. COMPUTED |
|---|---|---|---|---|---|
| | 0002 | 293333 | 0895305 | 0.00 | 0.00 |
| 0002 | 0006 | 293333 | 0895300 | 0.10 | 0.13 |
| 0006 | 0005 | 293330 | 0895300 | 0.24 | 0.09 |
| 0005 | 0004 | 293330 | 0895300 | 0.20 | 0.00 |
| 0004 | 0003 | 293330 | 0895300 | 0.07 | 0.00 |

Windows Abstra Version 2.3 -- Jan 1, 2004 -- Thu May 04 11:44:09 2006

SECTION
FROM  TO    E R R O R  M E S S A G E S

```
   Windows Abstra Version 2.3 -- Jan 1, 2004  Tue May 02 14:48:37 2006

                          -*- FIELD ABSTRACT -*-
060107-060107          HGZ L26879  4     6.0 MM ORDER 2 CLASS 1     PAGE  1
LEVELING AT TIDE STATION 876 1487 CHEF MENTEUR

        FROM           START   F/B  DIST   ELEV DIFF      -(F+B)  MEAN DIFF   I
             TO                    TOTAL                   TOTAL   FLD ELEV   C
                                    (KM)      (MT)          (MM)     (MT)

 0001 E 3145                                                         4.81800
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 E 3145           1071145 F    0.48    -4.61118  *    1.35     -4.61050  1
 0003 876 1487 B TIDAL 1071340 B    0.48     4.60983  *                       1
                                    0.48                   1.35      0.20750
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0003 876 1487 B TIDAL 1071250 F    0.20     0.32662  *   -0.81      0.32622  1
 0002 876 1487 A TIDAL 1071320 B    0.20    -0.32582  *                       1
                                    0.68                   0.55      0.53372
      ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction


  INSTRUMENT CODE      INSTRUMENT              RODS

           1          243 - 333294    396 - 24167     396 - 24168

                        LEVEL LINE SECTION RUNNING TREE

  0001
  0003
  0002
  FROM   TO        N. LATITUDE   W. LONGITUDE   FIELD DISTANCE VS. COMPUTED

        0001           300407        0894813            0.00        0.00
  0001  0003           300354        0894800            0.48        0.53
  0003  0002           300354        0894800            0.20        0.00
    Windows Abstra Version 2.3 -- Jan 1, 2004 -- Tue May 02 14:48:37 2006

   SECTION
  FROM  TO                      E R R O R  M E S S A G E S
```

```
   Windows Abstra Version 2.3 -- Jan 1, 2004  Thu May 04 14:38:56 2006

                          -*- FIELD ABSTRACT -*-
060118-060118         HGZ L26879  5     6.0 MM ORDER 2 CLASS 1     PAGE  1
LEVELING AT TIDE STATION 876 1799 M V PETROLEUM

        FROM          START   F/B  DIST   ELEV DIFF      -(F+B)  MEAN DIFF   I
             TO                   TOTAL                   TOTAL   FLD ELEV   C
                                   (KM)      (MT)          (MM)     (MT)

 0001 876 1799 B TIDAL                                             0.77300
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 876 1799 B TIDAL 1180829 B    0.08     0.22130  *    0.30    -0.22145  1
 0002 876 1799 A TIDAL 1180943 F    0.08    -0.22160  *                      1
                          SL 1      0.08                   0.30     0.55155
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 876 1799 B TIDAL 1180853 F    0.08    -0.34970  *    0.10    -0.34965  1
 0003 876 1799 C TIDAL 1180929 B    0.08     0.34960  *                      1
                                    0.08                   0.10     0.42335
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0003 876 1799 C TIDAL 1180910 F    0.08    -0.00180 R*    0.00    -0.00605  1
 0004 876 1799 D TIDAL 1180919 B    0.08     0.01030 R*                      1
                                    0.16                   0.10     0.41730
      ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction


  INSTRUMENT CODE      INSTRUMENT              RODS

           1          243 - 333294    396 - 24167     396 - 24168

                        LEVEL LINE SECTION RUNNING TREE

  0001 (0002)
  0003
  0004
  FROM   TO        N. LATITUDE   W. LONGITUDE   FIELD DISTANCE VS. COMPUTED

        0001          292947        0900133          0.00        0.00
  0001  0002          292948        0900130          0.08        0.09
  0001  0003          292948        0900130          0.08        0.09
  0003  0004          292948        0900130          0.08        0.00
    Windows Abstra Version 2.3 -- Jan 1, 2004 -- Thu May 04 14:38:56 2006

   SECTION
  FROM  TO                    E R R O R  M E S S A G E S

  0003 0004  *** All runnings for this section were rejected, all
                 elevations beyond this point are erroneous !
```

```
   Windows Abstra Version 2.3 -- Jan 1, 2004  Fri May 05 14:44:22 2006


                            -*- FIELD ABSTRACT -*-
060118-060118          HGZ L26879  6     6.0 MM ORDER 2 CLASS 1     PAGE  1
LEVELING AT TIDE STATION 876 1494 WEST POINT A LA HACHE

        FROM           START   F/B  DIST   ELEV DIFF      -(F+B)  MEAN DIFF   I
             TO                    TOTAL                   TOTAL   FLD ELEV   C
                                    (KM)      (MT)          (MM)     (MT)

 0001 876 1494 C TIDAL                                               0.57900
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0001 876 1494 C TIDAL 1181356 B    0.38    -1.02605  *   -0.37      1.02623  1
 0003 876 1494 B TIDAL 1181451 F    0.38     1.02642  *                       1
                                    0.38                  -0.37      1.60523
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
 0003 876 1494 B TIDAL 1181316 B    0.33    -1.93309  *   -0.43      1.93330  1
 0002 876 1494 A TIDAL 1181542 F    0.33     1.93352  *                       1
                                    0.71                  -0.80      3.53853
      ELEVATION REJECTION AND ERROR CODES

C - section elevation difference was rejected for cause
    ie. *43* record rejection code set to "F"
R - section elevation difference was rejected by Halperin rejection algorithm
@ - section elevation difference does not include refraction correction
* - section elevation difference does not include rod correction


  INSTRUMENT CODE      INSTRUMENT              RODS

           1          243 - 333294    396 - 24167     396 - 24168

                        LEVEL LINE SECTION RUNNING TREE

  0001
  0003
  0002
  FROM   TO        N. LATITUDE   W. LONGITUDE   FIELD DISTANCE VS. COMPUTED

        0001           293419        0894813           0.00        0.00
  0001  0003           293419        0894813           0.38        0.00
  0003  0002           293419        0894813           0.33        0.00
    Windows Abstra Version 2.3 -- Jan 1, 2004 -- Fri May 05 14:44:22 2006

   SECTION
  FROM  TO                      E R R O R  M E S S A G E S
```

The data below compares Second-Order, Class I, leveling for water level gauge reference performed in the 1980's with Second-Order, Class I, leveling for National Geodetic Survey, BlueBook, performed in 2006. The Local Mean Sea Level (LMSL) is roughly 0.2 feet above the North American Vertical Datum of 1988, readjusted for New Orleans in 2004 on the 65 Julian day of that year. 876 1678 Michoud Substation apparantly shows 0.5 feet of settlement.

These elevations are preliminary and subject to minor changes when they receive a final adjustment. They are based on Second-Order Class I leveling from a GPS-derived starting height that has an expected nominal absolute accuracy of 0.1-0.13 FEET

USE THIS COLUMN TO IDENTIFY SETTLED BM'S (OUTLIERS)

| ID | Location | BM stamping | elevation NAVD 88.2004.65 H (feet) | LMSL - NAVD 88.2004.65 height difference (feet) | height BM-LMSL H (feet) |
|---|---|---|---|---|---|
| 874 7437 | Bay Waveland Yacht Club, Bay St. Louis, Mississippi | | | | |
| | | NO 1 1968 | 5.24 | 0.37 | 4.87 |
| 876 1402 | U.S. Highway 90, The Rigolets | | | | |
| | | PIKE RM 3 | 9.19 | 0.26 | 8.93 |
| | | PIKE RESET | 8.19 | 0.20 | 7.99 |
| | | C 193 | not a Tidal BM | | |
| | | PIKE RM 4 | not a Tidal BM | | |
| 876 1487 | Chef Menteur, Chef Menteur Pass | | | | |
| | | E 3145 | 15.81 | 0.14 | 15.67 |
| | | 1487 B 1982 | 0.68 | 0.13 | 0.55 |
| | | 1488 A 1982 | 1.75 | 0.15 | 1.60 |
| 876 1602 | Lake Judge Perez, Hermitage Bayou | | | | |
| | | 1602 C 1985 | 0.53 | 0.09 | 0.45 |
| | | 1603 F 1987 | 1.37 | 0.09 | 1.28 |
| | | 1604 E 1985 | 0.94 | 0.09 | 0.85 |
| | | 1605 B 1985 | 0.72 | 0.08 | 0.64 |
| | | 1606 A 1985 | 0.60 | 0.09 | 0.51 |
| 876 1678 | Michoud Substation,ICWW | | | | |
| | | WES 19 1978 | -0.37 | -0.35 | -0.02 |
| | | 1678 A 1982 | 10.10 | -0.44 | 10.54 |
| | | WES 17 1978 | -1.31 | -0.24 | -1.07 |
| | | D 276 1969 | 2.43 | -0.30 | 2.73 |
| 876 1724 | Grand Isle, East Point, Louisiana | | | | |
| | | 876 1724 TIDAL 11 | 3.12 | 0.20 | 2.91 |
| 876 1799 | M.V. Petroleum Dock, Bayou St. Denis | | | | |
| | | 1799 B 1985 | 2.54 | 0.31 | 2.23 |
| | | 1799 A 1985 | 1.81 | 0.19 | 1.62 |
| | | 1799 C 1985 | 1.39 | 0.18 | 1.21 |
| | | 1799 D 1985 | REJECTED | | |
| 876 1927 | U.S.C.G. New Canal | | | | |
| | | ALCO 1931 | 6.15 | 0.27 | 5.88 |